

A NEW 70d
THEORY
OF

ACUTE and SLOW
Contin'd FEVERS:

WHEREIN

Besides the Appearances of such, and
the Manner of their Cure, occasionally,
the Structure of the Glands, and the Man-
ner and Laws of Secretion, the Operation
of Purgative, ~~Kontive~~, and Mercurial Me-
dicines are Mechanically explain'd.

To which is prefix'd,

An ESSAY

Concerning the
IMPROVEMENTS of the
THEORY of **MEDICINE.**

by Geo: Cheyne. M.D.

The Fourth Edition, with many Additions.

Si propius fles
Te capiet magis. — Horat. de Arte Poet.

L O N D O N:

Printed for GEORGE STRAHAN, at the
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*The Author being very much
engaged, could not revise and
correct this Edition.*



THE PREFACE.

TO write any Thing tolerable about Fevers, or any Thing worse than what has already been advanc'd by some one or other on the Head, is perhaps no easy Matter. The ridiculous Manner of accounting for their Causes and Symptoms, used by some Pretenders to Medicine and Philosophy, has perhaps contributed (in its way) to that Contempt, to which (with such Expence of Satyr and Wit) they and their Art have been expos'd.

I have not the Arrogance to think the few following Sheets will conduce any thing to wipe it off; but of this I'm sure, if this Theory prove False, the Choices

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behind are fewer by one of the true Kind,
which endeavours to account from their
Appearances from Mechanick Principles.

The wiser Part of Mankind are now
persuaded, That this Machine we carry
about, is nothing but an Infinity of Branch-
ing and Winding Canals, fill'd with Li-
quors of different Natures; and I am
mightily out in my Conjectures, if for the
future any be heard about Theories of Dis-
eases, or the Manner of the Operation of
Medicines, who do not reason from these
Data, and their necessary Consequences.
And seeing Continual Fevers are only a
Complication of Symptoms, which naturally
follow upon a general Obstruction of these
Canals (or the Glands which they consti-
tute) and the necessary Effects thereof, as I
reckon; None I hope will be angry, I have
call'd such a Manner of Accounting for
them, New, seeing for any thing I know
(as to the main thereof) it is really so.

For the Structure of the Glands, and
the Business of Secretion, the Foundation
is Bellini's, but I hope it has lost nothing
in my Hands. I have added some Things,
extended others, and made all plain and
consequential.

As

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As to the other Things here occasionally explain'd, which, adding what Bellini has advanc'd about Blood-Letting, make up the great and principal Operations perform'd by Medicines on animal Bodies; I have very frankly borrow'd what of them I found for my Purpose, from Borelli, the foresaid Bellini, and another Gentleman whom I reckon the Ornament of his Profession and our Country: But for the most Part, pointing at Place and Person. And I shall reckon my self no more a Plagiary for this, than a Lawyer is to be accounted one for quoting his Code, or Pandects.

The Occasion of entering upon these Thoughts, was the Noise and Bustle has been made among us about Vomiting in Fevers, about a Year ago: I endeavour'd to satisfy my self so as you may see, and had the Vanity to think there might be some as great Fools as I, if I be mistaken it's not the first time.

I have not been over nice in ranging the Particulars here contain'd; those who read the whole will see their Dependance, and for others I was not at the Pains to lay in.

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The Language is that which most easily dropt from my Pen at first writing, the Roughness of some Terms of Art I cou'd not avoid, and the Purity of the English Tongue is neither the growth of our Country, nor of my Occasions ; if it be intelligible it is all (and perhaps some may say more than) I design'd.

I neither expect nor desire any Reputation from these Papers, for I sufficiently know how few such things oblige. Besides I'm dreadfully afraid few will read them, and not over many understand them, for want of the necessary Qualifications, of a moderate Attention, and a smattering of the Mathematicks. The first is absolutely necessary, but for the latter, they may even have a strong Faith, tho' both for them and my self, I cou'd wish it were joyn'd with Knowledge.

As for Censure, I am in no great dread of it ; for I shall lye secure (because conceal'd) and see its Adversaries (if it have the Honour to provoke any) shoot at Rovers. If any shall take the Pains to confute what I have advanc'd, he may do it very safely for his humble Servant ; if he bungle
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it, he'll do me an honour, by shewing it is not such as every Body is able to disprove; if he do it to Purpose, he'll do me a Kindness, by freeing me from Errors. I design for the future to meddle no more with it, than if it had dropt from the Clouds.

In fine, all my present Concern is for the Bookseller; if he ben't a Loser, (which Misfortune wou'd be the most effectual Confutation) it is indifferent to me, whether it perish by a particular, or the general Conflagration.



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the Golden Ball, over against the Royal Ex-
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A N



A N
ESSAY
Concerning the
IMPROVEMENTS
OF THE
Theory of Medicine.



HERE are none of the
Liberal Arts more necessary
or useful to Mankind than
Medicine; and yet, by what
ill Fate I cannot tell, there
is not one of them which
is not brought nearer Perfection than it:
The Institutions of the most of the rest
are reckon'd necessary Qualifications for a

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2 Theory of MEDICINE.

Gentleman ; but few study *Medicine*, save those who design to live by the Practice thereof. How to account for this, is no easie Matter, unless we say (what is true) that for the most part it has been hitherto so scurvily treated, the Grounds of its Theory, and consequently of the Practice built thereon, made so precarious, absurd, and often contradictory, that Men (no otherwise oblig'd thereto) were loth to lay out their Time and Pains on such Uncertainties. They saw many Practitioners, rather *Empiricks* than *Physicians*, who prescrib'd such Remedies, as they read or heard had been successful in Cases, which they imagin'd like that of their Patients ; but knew nothing either of the Cause of the Distemper, or of the Reason of the Cure.

It is true indeed, it is so very hard to obtain any tolerable Knowledge of the History of Nature, and of the Springs of Life, of the Virtues of Medicines, and the Texture of the animal Body ; the Manner of the Operation of the former, and the Laws of the Motions of the latter, that this may be one very good Reason, why Medicine

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cine has not been farther advanced. Yet, notwithstanding all these, had the genuine and true Method of obtaining these Things been constantly and vigorously pursu'd but half the Time of what has pass'd, since *Medicine* first came to be cultivated ; it had made another Appearance than it does at this Day. If four thousand Years ago, when Men saw the glorious Body of the Sun rise sometimes in one Place, and sometimes in another, and set with the like Variety : At one Season just peep up, and then down again ; at another stay a long Time with us ; in one Place never disappear, at another never be seen for a considerable Period ; and at a third, stay and go at equal Distances of Time : When they saw the Brightness of a Summer's Noon-tide, all of a sudden, turn'd into the palpable Darkness of a Winter's Midnight, without knowing any Reason for the same : When they saw the Moon appear sometimes in one Figure, sometimes in another ; rise here to Day, there a few Days after ; and a short Time after this, no where at all ; at one Season all clear, the next Minute all over dark ; now stand, then go, now before the Sun, then behind him ; now

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near him, then far from him, with a thousand other Varieties : When they saw all the Changes, Vicissitudes, and various Positions of the Planets, the Uncertainties of the Tides, and the numberless Number and Order of the fix'd Stars: I say, then, when they only saw, and knew nothing more about these, if any had said, that all these infinite Varieties might be reduc'd to Rule and Order, that we might come to understand the Laws of their Motions, and the Nature of their Orbits, their Positions, Appearances, and Distances from us, and one another ; that we might come to predict their Settings and Rises, their Stations and Retrogradations, their full and partial Appearances, and their compleat and incompleat Disappearances, and that too almost to the greatest Precision we are capable to distinguish or apprehend. But (which is the utmost Perfection of these things) if any had said, we should at last come to understand the Reason and Cause of these various Motions and Appearances, he wou'd have scarcely been believ'd. And yet we know all these things have come to pass in our Days ; and that, only by pursuing a true Method, every one improving

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proving upon the Observation of his Predecessor, 'till all the *Phænomena* were compleatly gathered, and then applying the Science of Quantity, (*i.e.* Geometry and Numbers) to investigate their Orbits, their Distances, the Laws of their Motions, their Natures, and their Causes; by such Means as these, Men have brought *Astronomy* almost to the highest Pinnacle of Perfection. Now, if *Medicine* had been thus treated (as it ought to have been) but half the Time which has pass'd, since it came first to be cultivated; I can boldly affirm, if it had not been brought to Certainty and Demonstration; yet, it had been above the Contempt and Reproaches which are now daily thrown upon it; and had not been the common Theme of the lowest pretenders to Satyr and Wit.

WHATEVER be the Principle of Perception in human, or of Sensation in brute Animals; yet it is allow'd by all Sects of *Philosophers* and *Physicians*, that all the Distempers and Disorders of the Body of both are owing to a Vitiation of the Quantity, Quality, or Motion of the Fluids, or to a bad Disposition and

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Texture, a Distortion, Distention, Luxation, or Dilaceration of their Conduits, and the other solid Parts of their Bodies; and that Medicines operate by the Application and Mixtion of their Juices, or by a Communication of their Virtues to these. And seeing all these are the Modifications and Qualities of material Beings, which have the Dimensions of Bodies, and are therefore *Quanta*; it necessarily follows, that the only Method of examining the Effects and Causes of these Qualities is by applying to them the Doctrine of Quantity, *i. e.* Geometry and Numbers; and it is altogether unaccountable, how the World has not been sufficiently aware of this, 'till within these few Years.

THE Ancients indeed have given us many noble Remedies for several Distempers; many sound Advices about the Management of a Patient, and for the Discovery of the Names (not the Natures) of the most of Diseases, by telling us what Antecedents, Consequents, and Concomitants were affix'd to such a Distemper, which they call'd by such a Name. In a word, they have done tolerably as to the practical Part; tho',

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tho', after all, many of their Receipts and Remedies seem very little to us now: For such is the Intemperance, Indiscretion and Lewdness (to which, either personal or transmitted, I wou'd ascribe many of our Maladies) of our Days, that we are in compleat Possession of all their Diseases, heighten'd by as many Degrees of Malignity, as there are Years betwixt us and them; and in the mean Time we have begotten an infinite Variety of plaguy new ones, against which, most of their Remedies wou'd have less Force, than the Children of our Age against the Giants of theirs. However, Practice was the only Part of Medicine they can be said to have any whit improved. For *Theory*: As their Philosophy was not tolerable, so their Anatomy was little better, and their Natural History worst of all; insomuch, that they were almost destitute of the necessary *Præcognita* thereto. It is true, they all requir'd, in a Student of Medicine, a Knowledge in Geometry and Numbers; and thought it indispensably necessary to any one, who shou'd offer to dispense a Drug, adjust a Composition, or give an Account of the Manner of the Operation of Medicaments; yea,

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sometimes we have a few Hints of the Application of these in some Cases; Yet, it cannot be deny'd, they made less Use of it than they might and shou'd have done, to the great Detriment of Medicine, as it is a *Science*. An evident Instance of this is the Circulation of the Blood, which, if they had but very little considered the Laws of Motion, and the Elements of Geometry, they cou'd not have been ignorant of, as certainly all that are not bigotted must acknowledge they were.

THOSE, betwixt the Ancients and them of these two last Centuries, treated Medicine as all other Sciences were then used: They translated, commented, and borrowed from the Ancients, and one another; made a great Pother about Words, and Tropes, and Metaphors; but, for the most Part, left the Science in no better State than they found it. It is true, there have been some great Men, in all Ages, who have managed their Provinces with Skill and Address: But it is certain, that Part of Medicine, we are now enquiring into, receiv'd but few Improvements in those Days.

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AFTER the Time of the Restauration of Letters, *Medicine* advanc'd proportionally with other Sciences; Anatomy was enquir'd into with good Success by some; the History of Nature, Philosophy, and Chymistry, by others; so that, e're this Time, the theorick Part of *Medicine* had arriv'd to a considerable Perfection, had not these two last, misapply'd, step'd in to hinder the same.

THE *Philosophick Physicians* were so fond of their Systems, that every medical Appearance must do them Homage: All was resolv'd into substantial Forms, Sympathies, and Antipathies, &c. or into subtile Æther, Congruities, and Incongruities, &c. wou'd they, nill'd they; not considering that the first of these is a meer Metaphor, *i. e.* in the present Case, Words without a distinct Meaning; and that the second is plain Nonsense, unless these things naturally follow from the determin'd Laws of Motion; and, in a word, that all Natural Philosophy, unless supported by Geometry, is but a pleasant *Romance*.

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THE *Chymical Physicians* were yet more wild to introduce their *Laboratories* into the Bodies of Animals; and to expect the same Effects from our Vessels, as from their Retorts. Some of them have resolv'd the Causes of all Diseases into Acids; and therefore they must be cured by Alcalious Remedies: Others, by an opposite Extreme, have resolv'd Diseases into these, and therefore they must be cur'd by those. They have made a great Noise with their Fermentations, Effervescences, and the like; while, in the mean time, we are certain, that neither the one nor the other is in the right, and that the Heat of our Bodies is no wise able to produce the same Effect with their Furnaces; neither are we able to mix three or four different Liquors in a fine Glass Tube, much less can we expect such Effects, as they ascribe to their Fermentations, from the much more slender Canals of animal Bodies, I shall not offer at a formal Confutation of these different *Ætiologists*; the Matter has been done, or will be done, by much better Pens; but this in the general I may say, That allowing these Gentlemen all they
crave,

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crave, yet still all is Nonsense, unless they first shew their Systems and Chymical Effects to be necessary Corollaries from the known Laws of Motion, *i. e.* unless all their Philosophy, and Chymistry too, be first mechanically explain'd; which most of these Gentlemen do not pretend to.

Gallileo, Torricelli, and Paschal, the first by Water, the other by Mercury, and the third from the Effects of one and the same Experiment, at different Heights, brought to light these three grand Properties of the Air (that Fluid, which is so absolutely necessary, and so universally useful, both to the Being and Operations of Animals and Vegetables) to wit, its Elasticity, Gravity, and circumambient Pressure, which have serv'd in great stead toward the mechanical Explication of the animal Oeconomy. *Snellius* first found out the true Measure of the Refractions of Light, which serves to explain the Phænomena of Vision: And several have shewn the Analogy betwixt the Motions of musical Organs, and their Effects on the ambient Fluid, and the Vibrations of a Pendulum, whereby the Diversities of
Sound,

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Sound, and the Manner of Hearing, are explain'd.

Des Cartes, by a bold (not to say impious) Attempt, was the first (since *Prometheus* and *Democritus's* Days) who endeavoured to create an Animal, *Magnis tamen excidit ausis*. But to be just to him, he was no mean Person; for, not to speak of the Analytical and Geometrical Improvements, which are acknowledg'd to be his, (such are the Solution of Biquadratick *Æquations*, the Analytical Investigation of all *Loca*, the Expression of the Natures of Curves by *Æquations*, which renders them so manageable; the Geometrical Construction of *Æquations* of all Degrees, the Determination of the Curves of Reflexion and Refraction (which had perfected Optical Machines as to the Theory, had not a wonderful Property of Light, since discover'd, come cross to it) the Manner of the Investigation of which Three, the greatest Men of this, or any other Age, have lately thought it worth their Pains to shew: But above all, the Invention of a Method of Tangents, which was unknown to the World before; (and how comprehensive the

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the same Method is, *Hudde* and *L' Hospital* have shewn) I say, beside all these, it was he who first banish'd effectually the *Aristotelian* Jargon, and made Men reflect upon the natural Right they had to a Freedom of Thinking: And tho' for the most part he did substitute a bad System in its room, yet it was such an one, as made Men reflect more upon the Necessity of applying Geometry to Natural Philosophy; but which is most for our present Purpose, he was the first who explain'd mechanically the Nature of Vision, and the Construction of the Eye: He has likewise giv'n several considerable Hints towards the better Understanding of the Nature of Sound, how it acts on our Organs, and raises the several Passions, both in his other Works, and in his *Compendium* of Musick; and tho' this last Treatise be unlick'd and unshap'd, and never design'd for the Publick, as himself says, yet it has some few uncommon Touches not unworthy its Author.

BUT all hitherto done was only pickering, or rather storming the Out-works of *Theory of Medicine*; the Fort was safe and intire, till the noble *Har-*

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vey gave it a fatal Shock in the Discovery of the *Circulation* of the *Blood*; a Discovery so wonderful, useful and happy, that all Ages will admire and bless its Author; a Discovery so conformable to the Rules of Mechanism, and the Laws of Motion, and so fitted to that Geometry, the wise Director of Nature uses in all his wonderful Works; in a word, a Discovery, which has let in more Light into the *Theory of Medicine*, than almost all the former join'd together.

ABOUT this Time, *Steno* endeavour'd to give an Account of the true Structure of uncompounded *Muscles*, and to explain mechanically the manner of their Operation: And tho' he was mistaken in both, yet by this Attempt, he reduc'd the Choices behind into a lesser Number, and encreas'd Mens Desires to search into the true Mechanism of these Wonders of Nature. He likewise publish'd a Treatise, *De Solido intra Solidum*, wherein, besides several useful things in Natural Philosophy, there are some which have been since happily apply'd to that Part of *Medicine* we are now enquiring into.

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Sanctorius likewise, in his admirable Treatise of *Statical Medicine*, has obliged the World with many excellent Rules of Health, and many useful Observations of the Quantities and Proportions of the several natural *Evacuati- ons*, and the Effects of the Suppressions of these, whereby Men are enabled to talk more distinctly, and not left to guess at random about such Things. It is to him, likewise, we owe the Invention of what is now call'd the *Thermometer*, whereby we are not only enabled to distinguish the several Degrees of Heat and Cold, to a much greater Exactness than formerly, by our bare Senses; but likewise to prognosticate something about the Changes of the Weather; but which is most of all, we are thereby enabled to understand something more than formerly, about the Cause of the unnatural Ascent of the nutritious Juices in Plants and Vegetables.

AT last came out that surprizing Piece of *Borelli's De Motu Animalium*, giving the true Mechanism of the external Motions of Animals, and forward Advances in that of the internal Motions: For him

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was reserv'd the great Honour of augmenting the Number of Sciences by one; one, the noblest and most admirable that ever human Wit invented! For, by a vast Skill in Mechanicks, and a wonderful happy Subtilty of Genius, he not only invented, but, himself alone, almost perfected that Science; a piece of good Fortune, which seldom ever happened to one and the same Person. His first Part of the external Motions is perfectly charming, infomuch, that nothing fuller and more compleat can be desir'd on the Head. It is true, the most ingenious *John Bernoulli*, the worthy Professor of Mathematicks at *Groningen*, (from a Property of Fluids, and a Method of Investigation, which was not known to *Borelli*) has giv'n the Grounds of a much exacter Calculation of the Elevation of the *Pondera* from their giv'n Resistances, and the Dilatations of the *Machinulae* which constitute the distractile *Fibres* of the *Muscles*, than *Borelli's*, in the 98th Propolition of his first Part; and has likewise drawn many ingenious Corollaries from that Speculation, determining the Curve these *Machinulae* would describe, by a Section through their Direction, and the Proportions

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tions of the *Liquidum Nervorum*, or, as he calls it, the *Aura motiva* to the *Pondera elevanda*. But it must be granted, *Borelli* has made the best use of all the Geometry known in his Days of any who went before him. In his second Part, he has many admirable Propositions for calculating the Force of the Heart, and the *Impetus* which the Arterial Blood receives from it, the determining the Necessity of its giv'n Structure, the Manner, Nature, and Use of Respiration ; besides many useful Hints for the Discovery of the Motions and Natures of the Fluids of the Body. But it must be confess'd, this Part is not near so compleat as the other : Some of the Motions of the Fluids, and the Natures of the Canals, were things not manageable by his Geometry ; and he neither had so perfect a Skill in the *Practical* Part of *Medicine*, nor was Anatomy so fully discover'd as now to compleat that Part.

HIS noble Disciple *Bellini* has taken up the Science where he left it. He, by an exact Skill in Anatomy, a perfect Knowledge in the *Practical* Part of *Medicine*, a nice and true Observation of

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the less common Effects of Nature, and a good Understanding in the Mechanical Philosophy, has much improv'd that Part of the internal Motions of Animals: He has nicely distinguish'd the Natures and Differences of Urines and Pulses; He has justly explain'd the Effects of Blood-letting in several ingenious Propositions: He has handled the general Causes and Distinctions of Fevers; the Manner of the Operation of some Medicaments, the Diseases of the Head and Breast, after a Manner no less uncommon than genuine; whereby he has put a quite new, but natural Face on Medicine, and reduc'd it pretty near to a Science, which was before but a Trade. There are several useful and ingenious Propositions in his late Book, about the Motion of the Heart, the Blood, and the other Fluids; the Manner how to discover the Tendency of the Fluid from the Figure of the Canal giv'n, a Confutation of the *Chymical* Fermentations in Secretion, and an Illustration of his former Treatise about Blood-letting. But in my Opinion, the noblest and most admirably useful Part of his whole Works, is that about the true Structure of the *Glands*, and his Hints about the
Laws

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Laws and Manner of Secretion. It is a great Pity, that he has not, or will not explain this more fully himself; for I reckon it, and the *Circulation* of the Blood, to be the Key, whereby the *Geometria recondita* will have admittance into, and let in an *Ocean* of Light to these dark internal Regions.

OUR Countryman, Doctor *Pitcairne*, has admirably illustrated this Part, so far as the Labour of constant Teaching in one Place, or the Hurry of a toilsome Practice in another cou'd allow; He has demonstrated the genuine Nature of the *Circulation* of the Blood, by shewing the necessity of the Continuity of the Veins to the Arteries; He has shewn the Mechanical Structure of the Lungs, and thence, the necessary Effects of Respiration; He has assign'd the Organs their Force and Nature, and the true manner of Digestion, and freed us from the Fury of a corroding *Menstruum*: He has demonstrated the necessity of Obstructions rather happening in the Arteries than in the Nerves, and in the Nerves rather than Veins; and how these Obstructions are produc'd: He has demonstrated the Evacua-

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tions proper in Fevers, and the Cause and Nature of the Diseases of the Eye : He has banish'd effectually the plausible Congruity of Pores in Secretion, the ridiculous Cant of Acids and Alkali's, and the whimsical Fancy of Ferments ; besides many other noble Hints, which his manly *Laconick* Eloquence has left undetail'd to the Sagacity of the attentive Reader.

BESIDES all these, several Gentlemen of the *Royal Society* at *London*, (which did cast the first Copy to the rest of *Europe*) and of the *Royal Academy* of Sciences in *France*, and of several other Philosophic Societies, have discover'd many useful Theorems, and made many noble Experiments, toward the Illustration of the Mechanical *Theory of Medicine*, which are never sufficiently to be admir'd or commended.

THESE are the Men, and this is a short Account of what they have done, so far as I know or remember, toward the *Theoretick* Part (at least, toward what I think deserves that Name) of Medicine. A great many Noble Things this way they have done, and many considerable Difficulties they have

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overcome: But it cannot be deny'd, there still remains an ample Field for the Industry of the present and future Ages. It wou'd suppose, that one knoweth (which God knows I do not) all that has been hitherto discover'd, and that he were almost able to supply the Remainder, to give a particular Account of what is wanting in this Part: However, I shall venture to give my Opinion of somethings which are evidently deficient.

I. THO' I think the greater, and more easily conspicuous Organs and Parts of Animals and Vegetables, be entirely discover'd by the Industry of ingenious Anatomists of our *Island*, and those of other Countries; yet I think we have not, as yet, so compleat an Inspection into the more minute and less obvious Parts of these, which must be absolutely necessary toward a compleat Theory of Medicine: We have not, as yet, trac'd the Continuation of the Arteries, Veins, and Nerves, so far as they go, not so far as I hope they may be trac'd; We have not, as yet, a perfect Discovery of the Texture of the Brain in all its Parts: We have not, as yet, been able to evolve

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the compounding Vessels of any more Glands, than the Intestines and *Testiculi*: We want the true Texture of the *Liver, Pancreas, Spleen, Kidneys*, and all the other Conglobulous and Conglomerate Glands: We have not discover'd the Texture and Range of the Vessels under the *Cuticula*. But, which is worst of all, we have not, as yet, determin'd the true Situation, nor Position, the Windings and Branchings, the Angles they make with one another, or the Curves they describe, of most of the known and visible Canals, which might be easily done. The Anatomy of Human Bodies is as yet very imperfect, and our *Comparative Anatomy* is quite lame: Besides, a Thousand other Things which might be here added, which are necessary to a true Theory; for unless our Theories and Observations confirm one another, they shall be still little more than the most probable Conjectures. The Performances of *Malpighius, Dr. Grew, Lewenhoeck*, and others, as to this deficient Part, are very well; but still there are here many things desirable, which I hope are reserv'd for some of these, or others, endu'd with a dextrous Hand, a quick Sight and Observation;

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tion ; assisted with fine Microscopes, and a good Skill, both in the common and more abstruse Geometry.

II. WE evidently want a compleat *History of Nature*, *i. e.* the Names and Natures, the Distinctions and Properties, of the Animal, Vegetable, and Mineral Kingdoms. It is true, much has been done already, and still is a doing, this way, by the noble Members of Philosophic Societies, and other private Persons ; yet still very much is wanting. And till that Part of it, which is necessary in Medicine (and how far that may extend none can tell) be perfected, we cannot expect a compleat Theory thereof : For all know how useful a perfect Skill in the Nature and Virtues of the Remedies, is, to the full understanding the Disease, and the manner of its Cure.

III. WE want a compleat System of Mechanick Philosophy, *i. e.* an Account of all the visible Effects of Nature upon Geometrick Principles ; for it is not Systems, as they are an Explication of all the Effects of Nature from the same Principles, which are so justly ridicul'd,

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cul'd, but Systems, as they are ungeometrical. It is true indeed, all the great, visible, constant and uniform *Phænomena* of Nature have been attempted by the eminent Mathematicians of this and the last Age, but accounted for, from rigorous Geometry, by that stupendiously Great Man, Mr. *Newton*, *Quem secula nulla tacebunt*: He has not only giv'n the true Causes of these *Grand Appearances*, the Laws of Motion, and the Nature of Fluids, the Nature of Light and Sound, the Manner and Rules of their Propagation; in a Word, all the general Mathematical Principles, whereby to examine the Pretensions of different Systems, and many new surprizing Problems and Theorems in the speculative Part of Geometry; but he has likewise discover'd the true Principle of all the Effects of Nature, to wit, Attraction, or Gravitation: But, which is most of all, to him we owe the only Key, whereby the Secrets of Nature are unlock'd, to wit, the general Way of managing *Æquations*, the Methods of *Infinite Series's*, and of *Fluxions*, direct and inverse; Examples of which, his whole *Principia* are. This is that which will bring *Analyticks*,
Geo.

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Geometry, Natural Philosophy, and the Theory of Medicine, to their utmost Perfection, if ever they get thither: By these we are able to contract all the Mysteries of the Ancient and Modern Geometers into the room of a few Lines, and disclose them with a few Scrapes of our Pens; of which, when People see the Conclusions, without knowing these Methods, they look like conjuring, or something above the Capacity of Men. Yet, after all, these Methods have not as yet been apply'd to the lesser, less obvious, less constant, and less uniform Effects of Nature, of which we are principally speaking here, and which are so absolutely necessary to a true Theory of Medicine: And tho' I am perswaded, that from the same Principles the grand Appearances of Nature have been accounted for, these more minute ones may be so too; yet it is what has not been actually done, and without which we shall be still straitned in our Theories. We want to know the Mechanical Account of Chymical Operations, and Preparations of several sorts; which is a vast Defect: We want to know something more about the Nature of Fluidity, and what it is makes up the many

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ny Varieties and Differences of Fluids from one another; the Figures of their constituent Particles, and a compleat Collection of the Laws of their Motions: We want to know the true and adequate Nature and Cause of Heat and Cold, and the Reason of their odd Effects: We know not the Figures of the Particles of Bodies which produce such Varieties of Tastes: We want to know the Figures of the Particles of Bodies, which naturally form themselves into such and such Shapes, after the manner *Hugens* has analys'd Island Crystal; this wou'd be of mighty use toward the full understanding of the Natures of all Saline Bodies, which generally form themselves into determin'd Figures: We do not, as yet, understand the Principles of *Individuation* (if I may so call it) of one kind of Body from another; Why some have such Grains, Colours, and Shapes, others different: We know not the true Nature and Cause of *Elasticity*, which is of so great Extent in the Animal Oeconomy: We want to know a great deal more about Light and Colours, Opacity and Transparency, tho' we hope to receive Satisfaction therein shortly, from that great Per-

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Person, who has so dearly oblig'd the World already. These, and a Thousand other Things, we want, which he only can enumerate, who cou'd supply them: And tho' we have many and noble Hints in most of these, from *Borelli*, Mr. *Newton*, and some other Mathematicians, yet we have not so perfect a Knowledge of them as might be desir'd, and, as I hope, may some Day or other be obtain'd.

IV. Lastly, We want a *Principia Medicinæ Theoreticæ Mathematicæ*: Albeit the Theory of Medicine and Natural Philosophy be nearly ally'd, and tho' the lately mention'd great Man has almost compleated the latter, yet he did it not with that View to be mainly subservient to the former: And tho' *Borelli*, in his excellent Book, *De vi Percussionis, & de Motu Naturæ a Gravitate factis*, has demonstrated several things useful to that Purpose, yet he concern'd himself mainly but with those things which he thought necessary to the understanding of his Book, *De Motu Animalium*: So that, notwithstanding of both these, we have not such a Book as I reckon this shou'd be. Such a Book
(among

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(among many other things, which I am not capable to enumerate) shou'd at least contain these things: 1. It should contain the true Nature of Fluidity, wherein it consists, and what it is that makes one Fluid differ from another, the Figures of their constituent Particles and why there are Solids of such and such determin'd Shapes naturally generated in each particular Fluid; the general Laws of the Motions of all Fluids, and the particular ones of each different Kind, whether homogeneous and uniform, or a Mixture of several different Kinds. 2. It shou'd contain the Nature and Cause of Elasticity, and the Figure of the constituent Particles of Elastic Bodies, and the Laws of the Percussions and Reflections of such; the Curve, into which Elastick Bodies naturally form themselves, when bended, if they observe one constant Law, *i. e.* if the Tension be always proportional to the bending Force; or the several Curves they must describe; if different Elastick Bodies observe different Proportions, (as *James Bernoulli* has done) which wou'd be infinitely useful in the Theory of Medicine. 3. Since it is certain now, that Glands are nothing but a
Com-

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Complication and Circumvolution of the Arteries into Curves of such and such Natures and Numbers, or into *Plica*, whose Turnings are Curves, or make right-lin'd Angles of such and such Quantities : Such a Book ought to determine the Effects arising in the Fluids, as to the Acceleration or Retardation of their Motion, their Viscidity or Fluidity, the Comminution or Augmentation of their constituent Particles, when mov'd in Canals turn'd and complicated into all possible curve or right-lin'd Figures ; and what Effects wou'd arise in the curv'd Canals themselves, as to their Elasticity or Distractility in being turn'd into such and such Curves. I imagine it is some such thing as this, which *Gulielmini* promises in the Preface of his Treatise, *De Aquarum fluentium mensura* ; For we know the Laws of the Motions of Fluids in direct Canals, already. This wou'd be a Work of vast Labour, but of noble Use ; and we know not but general Methods might be fall'n upon to alleviate the Labour of the Calculations. Mr. *Newton* has giv'n one Theorem in two Lines, which, if rightly manag'd, will give the Quadratures, Rectifications, Surfaces, Solidities

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lilities, Centers of Gravity and Percussion, or Oscillation of all imaginable Curves and solids, whose Natures can be express'd by any Analytical Equation whatsoever. I know of something like the same done for all Curves and Solids, whose Natures are express'd by Transcendent or Exponential Equations, *i. e.* such as he calls *Geometricè Irrationales*: And perhaps both these last may be compounded into one, and consequently comprehend the first likewise. Now, if such general Methods were fallen upon, for these which we are speaking of, it wou'd save a great deal of Calculation, Reading, and Writing; and why it may not, I see no Reason to doubt. 4. It ought to contain a Calculation of Determination of what Effects the Fluids wou'd have upon one another and upon Canals form'd into such Curves, upon an Augmentation or Diminution of their Quantities, an Acceleration or Retardation of their Motions, the Encrease or Diminution of their specifick Gravities, or of the Bulk and Figure of their constituent Particles; or the Alteration of their Fluidities, or Viscidities. 5. It should contain what Effects solid Particles of
all

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all Figures, Sizes, and different Gravities, mixt with Fluids of all kinds, wou'd have upon the Fluids themselves, or upon the distractile Canals of such and such Figures. 6. Lastly, it ought to contain the final Causes, and the Mechanical necessity of the giv'n Figures of the more solid Parts of the Body: Why some Glands are Conglobous, others Conglomerate, as they are call'd; Why the Testicles resemble a Spheroid, generated by the Circumvolution of the Semi-ellipsis about its longest Axis; and the Heart, one generated by the Circumvolution of a Semi-ellipsis about a Diameter oblique to its longest Axis, or at an Angle of 45 Degrees with the same. Why the Muscles, some of them are of one Figure and Texture, some of them of another; some situate near the Part to be mov'd, others at a greater Distance from it. Now, tho' many of these things, here mention'd, are to be found already accounted for, and demonstrated in the Writings of the Geometers of this Age: Yet one, who professedly design'd to treat of these things for the Benefit of Medicine, shou'd either transcribe them out of these, or demonstrate them a-new after his own Method, that we might have all that
be-

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belongs to this Subject together in one Book.

BUT after all, perhaps, it may be said, such a Chimerical Piece as this, toward which there are required so many hard (not to say impossible) things, will never be written by all the Wit of Men. To this, I answer, That there are very great Advances towards such a Piece already made, and if a few ingenious Men, endowed with a perfect skill in the Abstract Geometry, and the new Methods of Investigation, shou'd but manage this Province after the manner we formerly shew'd Astronomy had been treated, each improving the Discoveries of the other, the one beginning where the other had left off; I doubt not, but these I have mention'd, and harder things too, might be brought to pass: And if once such a Book as this was finish'd, and the other necessary perquisites search'd into, Medicine in a short time might be brought to the immediate Confines of Demonstration.

THERE are two things, which wou'd mightily conduce toward the perfecting such a Work as this of the *Principia*

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cipia Medicina Mathematica. The first is, the publishing something concerning the *Inverse Method of Fluxions*, or as the *French* call it, *La Methode de Calcul integral*; which might contain the Application thereof to all the intricate Problems of Geometry, and give general Canons for the Solution of all such, and likewise general Precepts for the Application of the same to Mechanick and Natural Philosophy, with the Illustration of them by many particular Examples from Mr. *Newton's Principia*, and the noble Problems solv'd within these Dozen Years, and publish'd in the *Philosophic Transactions*, *Acta Lypsiæ*, and *Journals des Scavans*. For tho' a Man with a great deal of Pains may gather the Materials of such a Book, from Scraps here and there, yet there are few who have so much leisure, or if they have, will give themselves the trouble; or if they cou'd do both, have the Convenience of searching into so many different Books, to gather up what is necessary to furnish them with a tolerable Knowledge of this wonderful Method: And therefore it would be of great Use to the World, and to the Improvement of Learning in general, that a

D

Book

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Book containing, at least, all that is already publish'd on this Head were compil'd and set in a clear Order. It is true; the noble *Leibnitzius* has promis'd such a Book as this, but I am afraid his great Employment will deprive us too long of that Advantage; Besides, I doubt he will not condescend to the Capacity of the lower Rank of Geometers, for which such a Book should be principally design'd. *Carre* indeed has giv'n the first Rudiments of such a Work, but he is so far from giving an Account of all that is publish'd this way already, that I am afraid he has not understood them himself, his Performances on that Head being so very low. A second Thing, which wou'd very much conduce toward the Work we were speaking of, is, that the great Geometers of this present Age wou'd be pleas'd to publish those many noble Secrets of Geometry and Philosophy, which, to the great Detriment of Learning, they think fit to conceal: What Reasons they have for doing so, they know best themselves, but I am sure it wou'd be a greater Honour done to themselves, and a greater Advantage to the Age they live in, and in particular

to

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to the Mathematicks, to communicate
to the publick such things, as they know
have not as yet been made common, when
to keep up the Method, more in Vigour
among some, of proposing hard Problems,
(which are at least suppos'd, known by
the Proposers,) to employ the Time of o-
thers, which might be laid out on Things
as yet unknown. This would put an end
to the Contentions about the Elogium of
Inventions, and prevent the melanchol-
ly Disappointment arising from finding
out excellent Things, and yet not to be
reckon'd the Inventors of them. There
could be no greater Encouragement for
an ingenious Man, than to be sure he
should not be slow in his Time again, if
he were successful in his Design, that
is, to be sure he is not already pre-
vented. we must know him had been
yet lost I tell us, however, all that I shall
say
Thus I have frankly given my hasty
Thoughts about Things of very great
importance: But hope the candid Rea-
der will more easily pardon the many
Escapes of this rude Draught of an Es-
say, for these Reasons. First, that it
was written in a Place destitute of all
common Assurances, and that I could be
at no ease till it was done, the Book-

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seller pressing to have it without any Delay: And in the next Place, that if ever I shall be betray'd into publishing any thing again, it should be on a Subject less obnoxious to wrangle, and where there is a surer Guide than *Imagination*. For to deal freely with the Reader, it was out of meer Indignation that I put Pen to Paper on this Subject, having seen it so unskillfully manag'd by two of our own Physicians here in Town, who some time ago play'd at *Logger-heads*, about Vomitting in Fevers. I owe them thanks, for the many good Words, and a few good Offices they have ineffectually endeavour'd to do for him whom they suspected to be the Author (how far their Kindness would have extended itself toward him, who's the Author, indeed had they known him, we may easily guess;) however, all that I shall say of them, is, that the one (that Enemy to all Schemes, Figures, Sense, and Demonstrations) had a bad Cause, and defended it most wretchedly: And that the other, having imitated the Practice of better Physicians, was not so happy as to imitate their Reasoning, but spoil'd a good Cause by bad Arguments.



ed, if we find a NEW Machine is disorder-
 ing such a particular Part, we might
 with us up, from that Machine, if
 any one of the Parts, which had
 disorder'd the Machine; especially, if
 after the whole was taken to pieces, we
 should find them found, have that
 particular one.

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maker, by adjusting only the Balance
 of a Watch, make her go right; we
 thereof had occasion'd her going wrong;

POSTULATA.
 as they should be

I.  H A T the whole Body is
 nothing but a Congeries of
 Canals, the greatest (at
 least a considerable) Part of
 which is *Glands*, properly so called, de-
 sign'd for the Separation of some Fluid.

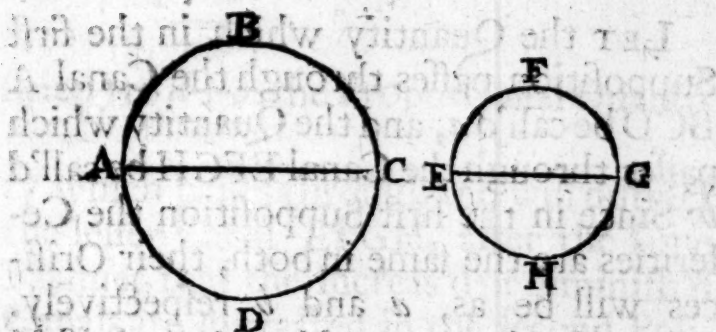
THIS is evident, when any Part of
 the Body is swell'd, so that the incon-
 spicuous ones become visible; and has

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 been clearly demonstrated by *Malpighi*;
Leuwenhoeck and others.

2. **THAT** when a Machine is disorder-
 ed, if we should see it Arighted by ad-
 justing such a particular Part, we might
 without Scruple affirm, that it was some
 Injury done to that Part, which had
 disorder'd the Machine; especially, if
 after the whole was taken to Pieces, we
 should find them all sound, save that
 particular one.

Thus, if we should see a Watch-
 maker, by adjusting only the Balance
 of a Watch, make her go right; we
 might say the Distortion of the Ax
 thereof had occasion'd her going wrong;
 especially, if all the other Parts be found
 as they should be.

LET there be a greater Distractile
 Cylindrical Canal, whose Orifice
 is **ABCD**, through which a giv'n Quan-
 tity of Liquor passes in a giv'n time;
 and a lesser one **EFGH**, through
 which a lesser Quantity of Liquor passes
 in the same time.



through which a proportionable Quantity of the same Liquor passes with the same Celerity as in the former: Let now the greater ABCD be increas'd or diminish'd by the lesser EFGH, so, as that in the increas'd or diminish'd Cylindrical Canals, the same Quantities only pass, which pass'd in the same Time in the first supposed Canal ABCD: To find the Quantity of the same Fluid, which will distract (and produce the other Effects of encreasing the Quantity of the passing Fluid, and consequently its Celerity) the Canal (by increasing its Diameter) first suppos'd, ABCD after the same Manner, only that the increas'd $(ABCD + EFGH)$ or diminish'd $(ABCD - EFGH)$ Canals are now distracted.

LET the Quantity which in the first Supposition passes through the Canal A BCD be call'd a , and the Quantity which passes through the Canal EFGH be call'd b : Since in the first Supposition the Celerities are the same in both, their Orifices will be as, a and b respectively. Likewise the increas'd and diminish'd Canals (seeing their Altitude is suppos'd the same) will be as their Orifices $a+b$, and $a-b$; and the Quantities passing through them in the same time, with the same Celerity, would be likewise as $a+b$ and $a-b$: But (in the second Supposition) the same Quantity is suppos'd to pass in the increas'd Canal ($a+b$) and diminish'd one ($a-b$) which pass'd in the first suppos'd Canal ABCD, or a ; therefore now the Quantities passing through the Canals, increased or diminish'd, will be as a : wherefore, as $a+b$, (the Quantity passing through the increas'd or diminish'd Canals in the first Supposition) is to a ; (the Quantity passing through them in the second Supposition) so is b , (the Quantity passing thro' the lesser Canal EFGH, in the first Supposition)

for the Length of the Ventricle of no
 $\frac{ab}{a+b}$
 fition) to $\frac{ab}{a+b}$, the Proportional Quanti-

ty which passes through and will distract
 the lesser Canal EFGH, after the same
 Manner that the increas'd or diminish'd
 Canals are distracted in the second Posi-
 tion. Adding or subtracting this Quan-
 tity from a , (which is as the Quantity
 passing through, or distracting the in-
 creas'd or diminish'd Canals) the Sum

or Difference $\frac{ab}{a+b} = \frac{a^2}{a+b}$ will be as

the Quantity which will distract the
 first suppos'd Canal ABCD after the
 same manner, &c. *q. i. e.*

SCHOLIUM.

THE whole Canals of the Body,
 (save the Intestines and Lacteals)
 may be considered as a concave Cylin-
 der, whose Base is the Orifice of the A-
 orta at its exit from the Heart; and whose
 Length is a mean Arithmetick proporti-
 onal betwixt the longest and shortest Ar-
 tery (I mean the whole Length of the
 Ar-

Artery till it degenerate into a Vein ; for the Length of the Veins are of no Consideration here) it being their splitting into Branches, which makes them not Cylindrical. Now, by *Postul. 1.* the Vessels which make up the Glands may have any Proportion of Minority to the whole of the Canals ; supposing then an Obstruction or Dilatation of the Glandular Vessels, it's evident the foresaid concave Cylinder will be thereby diminish'd or increas'd in any given Proportion : Suppose, *e. g.* the Diameter of the Cylinder so obstructed is to that of the whole, as 1 is to the $\sqrt{2}$; their Orifices will be as 1 to 2. Suppose again, there are twenty Pounds of Blood in a Man, seeing at the Beginning of the Arterial Vessels, (which constitute the Glands) the Velocity is near the same, as proceeding from the same Cause, the Compression of the Heart : Therefore divide 20 into two Parts, which may be (in this Case) as, 1. is to 2. (which

$$\text{done by this general Rule } x = \frac{m d}{m+n},$$

$$y =$$

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$y = \frac{m \cdot d}{m+n}$ putting d for the 20 Pounds,

x for the greater, and y for the lesser proportional Part, m to n their *Ratio*) The Parts will be here $6\frac{2}{3}$, and $13\frac{1}{3}$; which are the proportional Parts of 20 Pounds of Blood, which would naturally pass in the obstruct-Canal, and in the Remainder thereof, which is passable. But if all the 20 Pounds must now pass in the passable Canals, then it shall be distracted as much as if the whole Canals were passable; but that 30 Pounds of Blood were forced through it in the same time by the preceding Lemma. For in this Case $a = 20$, $b = 6\frac{2}{3}$,

$a-b = 13\frac{1}{3}$; and therefore $\frac{a}{a-b} = 30$.

If the Orifices were as 1 to 3. then $b=5$,

$a-b=15$ and $\frac{a}{a-b} = 26\frac{2}{3}$ this sup-
posing

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posing an Obstruction. If there be a Dilatation suppos'd in the same Propor-

tions, then $\frac{a}{a+b}$ will be in the first

Case 15, in the second 16. The same may be applyed to the *Liquidum Nervorum*, which passes in the Nervous Canals: For the *Gland* consists of a complicated *Nerve*, as well as *Arterie*, and in an Obstruction, or Dilatation of the same, both *Arterie* and *Nerve* are suppos'd to be obstructed or dilated.

THE Design of all this is to shew, that in an Obstruction or Dilatation of the Vessels, it is the same Thing as if the Liquors therein contain'd were augmented or diminish'd in a certain Proportion; as in the Case of the Blood-vessels, supposing 20 Pounds of Blood, (which is the ordinary Quantity) in a Man, and supposing one half of the whole (by an Obstruction in any Place of the said) Vessels were rendered impassable, it is the same thing *quam proxime*, as if the whole Blood-vessels were passable; but that one half more of Blood were

Continual FEVERS. 45

were forced through them in the same time, in which the 20 Pounds passed. Of the same Nature is.

LEMMA 2.

THE Blood being so corrupted, that the Strength is impair'd or increas'd, it is the same thing as if it were in its natural Estate, but that the Quantity thereof were diminish'd or increas'd in such a Proportion as is necessary for producing this Increase or Decrease of Strength.

THIS is 49th Prop. of *Bellini's* Book *de Motu Cordis*, &c. and its Converse: The Proposition it self is there demonstrated, and its Converse may be demonstrated after the same Manner exactly.

WHAT is here said of increasing or diminishing the Strength, is likewise true of all the necessary Effects of lessening or increasing the Quantity of Blood. These things premis'd, I come to

T H E

were forced through them in the time, in which the Nature is

General Proposition.

THE general and most effectual Cause of all Fevers, is the Obstruction or Dilatation of (the complicated Nerve and Arterie, the excretory Duct and conservatory one, or rather all these; which, as shall be afterward shewn, make up) the Glands, and they receive their Denomination, as these or those Glands are more or less obstructed or dilated.

OTHER Things may concur, but these are the most powerful Causes.

It were a Work of more Time, and Pains than I can at present bestow, to apply this Proposition to all particular Kinds of Fevers; tho' I am sufficiently satisfied it will account for All. I shall here only (as an Earnest of the rest) shew how to apply it to continual Fevers, and therefore contract the General into

T H E

Wherefore it will hence follow
T H E

Particular Proposition.

TH E most effectual Cause of continual Fevers, is an Obstruction of the Glands, which will necessarily augment the Quantity of the Blood and *Liquidum Nervorum*, in the passable Canals, and perhaps (by the Stagnation of the Fluids contain'd in these) to vitiate their Nature, as that they may be reckoned to concur as a partial Cause of these Fevers: But I rely most on the first, to wit, the Augmentation of these Fluids. For a Demonstration of this, I shall first shew, how it accounts for all the Appearances of such Fevers, and then subjoyn several Arguments to confirm the same.

SUPPOSING the Glands obstructed; the Quantity of the Blood in the Arteries, and the *Liquidum Nervorum* in the Nerves, may thereby be suppos'd augmented in any given Proportion of Minority to the whole Mass of these Liquors,

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quors, *per Lemma 1.* and its *Scholium*.
Wherefore it will hence follow,

§. 1. THAT the Pulses must be stronger and more frequent than ordinary, upon these Accounts. 1. Seeing there is a greater Quantity (than ordinary) of Blood in the *Arteries*, the Lateral Pression will be stronger; and seeing the *Arteries* are distractile, they will be driven outward with greater Force, and make a stronger *Ictus* upon any thing apply'd to them. 2. Seeing the Quantity of the Blood is augmented, *i. e.* the Quantity of the Matter whence the *Liquidum Nervorum* is generated, there must be a greater Plenty thereof (*per poster. part. Lemm. 2.*) generated, and consequently it will flow more plentifully and more quickly into the Heart, and make its contract oftner and more violently. 3. By the Obstruction of the *Glands*, the Influence of the *Liquidum Nervorum* thereinto is likewise obstructed; and therefore, *per Lemm. 1.* there will be a greater Quantity thereof left to flow in the passable *Nerves*, and it must flow *qua data porta*. 4. Lastly, The *Arteries* on every Side, running upon and touching the *Medullar Substance* and

and *Fibres* of the Brain, will (they being more than ordinarily distended) press them more than ordinarily, and make a more powerful and plentiful Derivation of the *Liquidum Nervorum* into the Places whither it can flow.

§ 2. FROM the same Cause the Inequality or Interruption of the Pulses is evident: For if the foresaid Pressions upon the *Nervous Fibres* of the Brain be so strong, that it either partly or *totally* occludes the Passage of the *Liquidum Nervorum*; there must be a Stop in the Derivation, till there be such a Quantity thereof collected, as shall be sufficient to over-power the *Impedimentum* occasioned by this Pressure, and so make an Inequality or Stop in the Contraction of the Heart. Moreover, when the Blood flows in such plenty, and with such Violence from the *Auricles* into the *Ventricles* of the Heart, it may force its way before the *Ventricle* be intirely contracted, and thereby cause an Irregularity in the Pulse. Add to these, what may proceed from the Thickness of the Blood (it being contracted into a less Space) and Evaporation of its Humidity. All these, either singly or compounded, will ac-

count for the Irregularities of the Pulses, which have hitherto been observed.

§ 3. GREAT Pains in the Head must ensue from the violent Distractions of the tender Vessels of the *Brain*, and from the great Pressure of the extended *Arteries*, upon the *Fibres* and *Membranes* thereof, all the Canals of every kind being bowld'ned with their respective Liquors; and that being the most sensible Place.

§ 4. A violent and burning Heat must be felt upon these Accounts, 1. Because there is a greater Quantity than ordinary running in the passable Canals, there must be a greater Motion than ordinary, and consequently a greater Heat. 2. Meerly upon the Account of the increas'd Quantity, (without considering the thereby produc'd greater Velocity) there must be felt a greater Heat. For supposing the Heat in each single Particle to be the same as before; yet since the Particles are more numerous in the same Place, the Heat must be greater there too: As in Rays contracted by a *concave speculum*. 3. The *Glands* being obstructed, *i. e.* the Passages

ges of Perspiration, the natural Heat must thereby be kept in, and consequently the whole augmented *per Lem.* 1. Hence proceeds our unquenchable Thirst; the Humidity (*i. e.* the thinnest Parts) being more ready to evaporate (since now the ordinary Passages are obstructed) the rest must be proportionally dryer.

§ 5. THE Difficulty and Frequency of Respiration, and the Violence of Expiration, is hence easily accounted for: The Quantity of Blood being augmented, there must a proportional greater Quantity thereof be deriv'd into the *Arteries* of the Lungs; and since every one of the little Vesicles of the *Bronchi* lie betwixt two *Arteries* thus inflated, it will be harder to explicate these Vesicles; and therefore one in such a State will naturally with all his Force endeavour to suck in the Air, which will be forc'd out again, both by these inflated *Arteries*, and by the Force of the *Muscles* of the *Breast*, *Diaphragm*, and *Lungs*; which is vastly augmented, both by the greater Quantity of Blood, and of the *Liquidum Nervorum*, and its more plentiful Derivation; as has been

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shewn in § 1. About the Frequency and Strength of the Pulses.

§ 6. THE Tongue is rough and discolour'd, because, by the violent Motion of the Blood, and the Obstruction of the common Passages, the Humidity is evaporated, and the extraordinary Heat stiffens the *Fibres* thereof. For it is evident, that only Heat and Dryness discolour the Tongue. *Vide* § 4.

§ 7. WANT of Sleep must follow both: Because there is such plenty of Blood, and consequently of the *Liquidum Nervorum* (as is shewn, § 1.) that there is no need of Sleep to generate more, which is one principal Use thereof: And because of divers Disorders of the Head (accounted for § 3.) which will not allow that Tranquility which is necessary to bring it on; but most of all, because (by the plenty of the *Liquidum Nervorum*) all the *Muscles* both involuntary and voluntary (especially those who want *Antagonists*) are in continual violent Motions, which must necessarily hinder Sleep.

§ 8. RAV-

§ 8. RAVINGS proceed from the Disorders in the Head, accounted for § 3. The *Nerves* being distracted by the abundance of their Liquor, the Heat and Dryness of their Parts, cannot perform these Reciprocations which are necessary in sound Persons.

§ 9. THE clear and flame-colour'd Urine proceeds from the Velocity of the Blood, which separates thereby only the thinnest of the mixt Fluid; as shall be shewn when we come to speak about Secretion.

§ 10. THE vast increase of Strength in Persons labouring under high Fevers, is evident from *Lemm.* 2.

§ 11. LASTLY, The Ceasing and Dissolution of Fevers by Purging, Sweating, Vomiting, and Abscesses, is wonderfully accounted for from this *Theory*. For if they go off by the Strength of Nature, then, seeing the greater Quantity and Velocity of the Blood produce a greater *Momentum*, by the frequent Concussions and Force of this, the Obstructions are shatter'd and wash'd away

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till the last Strokes carry away all together; and thereby go off in these or those, according as these or those *Glands* were most obstructed. This will be better understood, when we come to speak of *Mercurial Medicines*: If by the Assistance of Medicines; then the Medicines must be such as are most proper for removing these Obstructions, as shall be afterwards shewn.

1. THUS I think I have accounted for all the Appearances of *Continual Fevers*; which I reckon one considerable Argument for our *Theory*.

2. ALL we see done in the Dissolution or Ceasing of such *Fevers*, is the opening the *Glands*, the driving out the stagnated Fluids therein contain'd, which *per postul.* 2. is another Argument. And indeed one would hardly keep himself from thinking, that if the removing these Obstructions remov'd the Disease, then the putting them caus'd it: *Quoposito ponitur, & quo sublato tollitur.*

3. ALL that is observable upon opening Persons cut off by *Fevers*, is (the rest being sound and intire) an extraordinary

dinary Swelling and Lividity in the internal *Glands*; particularly of the *Lungs*, the *Liver*, the *Spleen* and the *Mesentery*; as has been observ'd by *Borelli* and others. *Vide Borelli de Motu Animal.* Part 2 prop. 227. This is one ocular *Demonstration* of our *Theory*; and if the other *Glands* were as conspicuous, I doubt not we should see the same in them.

4. A fourth Argument for our *Theory* is from what Dr. *Pitcairne* has demonstrated in his *Treatise* of the *Cure* of *Fevers*: For since in *Fevers* the *Glands* are obstructed, *i. e.* the *Conduits* of insensible Perspiration, then by removing this Obstruction, *i. e.* by increasing the insensible Perspiration, *Fevers* will be more probably cured, than by increasing all the sensible Evacuations: And that in the Proportion the Number of the *Glands* of the whole Body has to the Number of the *Glands* of the *primæ viæ*, or as the whole outward and inward *Surfaces* have to the *Surfaces* of the *primæ viæ proxime*.

5. A fifth Argument is from what *Belini* has demonstrated in his third and last Prop. in his *Section De Febribus*. He

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there shews continu'd *Fevers* may arise from a Vitiatio*n* in the Quantity, Quality, or Motion of the Blood; from all or either of these. . Moreover, from an Increase or Diminution of the Quantity of the Blood, there will necessarily arise an Augmentation or Diminution of its Velocity. The Motion depends upon the Quantity multiply'd into the Velocity, and the Quality arises (for the most Part) from a Combination of the necessary Effects of these. Hence you see, all that necessarily follows upon the whole three may be accounted for from the first of these, to wit, the Increase or Diminution of the Quantity of the Blood.

6. Amputations, Wounds, Fractures, and the like, wonderfully confirm this Doctr*ine*. For there, a considerable Number of the Blood-vessels are stopt, and cannot make their Circle, and consequently increase the Quantity of Blood in the rest: So that generally *Fevers* ensue, if the Quantity be not lessen'd by letting. It is true, the violent Pain may concur, since all Pain is a *Stimulus*, and *Stimulations* occasion a more plentiful Derivation of the *Liquidum Nervorum*.

But

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But if the Quantity of Blood be not suppos'd to be augmented, that Liquor must necessarily fail in a short Time.

7. WE may see visibly in *Fevers* from Cold, there is a violent Obstruction of the *Glands* of the *Skin*, the *Mouth*, *Larynx*, *Stomach*: In a Word, of all these *Glands* to which the cold Air is contiguous, and we can tell whence this Obstruction proceeds; besides this *Fever* may be increas'd to such a Degree as to differ little in its Symptoms, Violence, or Duration, from other more dangerous continual *Fevers*, which is a clear Demonstration of our Doctrine; for since an evident Obstruction of the *Glands* produces *Fevers* so very like the most dangerous ones; why may we not conclude that some latent and unknown Cause may produce so general and strong an Obstruction, as is able to occasion all the several more dangerous *Fevers* of this Kind?

9. BUT that which I take to be alone (without any other Proofs) a Demonstration of our *Theory*, is, That in all Countries betwixt the *Tropicks*, their Continual or Hot *Fevers* arise from

a severe cold Wind suddenly blowing after excessive Gleams of Heat. This is so true, that all Travellers assign this as the cause, having constantly observ'd their *Fevers* to succeed such sudden changes of the Air. A pregnant Instance of which we have in *Phil. Trans.* for *Decem.* 1669 N. 259. In a Letter from Mr. *Hugh Jones* to Dr. *Woodroof*, concerning some Observables in *Mary-land*; his Words are these. "The North-
 " West Wind is very sharp in Winter,
 " and even in the Heat of Summer it
 " mightily cools the Air; and too often
 " at that Time, a sudden North-West-
 " ern Wind strikes our Labourers into a
 " *Fever*, when they are not careful to
 " provide for it, and put on their Gar-
 " ments while they are at Work".
 Thus he. And indeed the genuine Account of the Matter is this; the excessive Heat must necessarily dilate the *Glands* to which it is contiguous, *i. e.* all the *cutaneous Glands*, the *Glands* of the *Trachea*, *Bronchi*, *Osophragus*, *Stomach*, and of the *Intestines*; and it will not only dilate them, but (by the Assistance of the natural Action of these, which is Secretion) exhale their respective Liquors, making them still flow, so long as the excessive

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cessive Heat continues, and as there is Blood which may supply them : Now they being thus dilated, and (by the *Efflux* of their Liquors) soft'ned and made spongy, a sudden excessive Cold supervening must strongly contract their Orifices, and congeal their flowing Liquors, and the greatness of their Contraction will be always in Proportion to the Violence of the former Heat and supervening Cold conjunctly; as is known from the Nature of Cold. And this Contraction of their Orifices and Congelation of their Fluids will obstruct the Motion of the Blood almost up to the Heart, at least to the next Division of the *Artery* which constitutes this *Gland*; whereby both the Blood will be increas'd as to its Quantity, and perhaps (by this Stagnation of a Part of the same) as to the Quality thereof likewise. All which is but a *Corollary* of our *Theory*.

10. HENCE we evidently see the Reason of the frequency of our last Years Fevers: For we were then exactly (in Proportion to our Climates) in the state of those betwixt the *Tropicks*. Our Summer-Day Heats were more violent than had been observ'd among us in the Memory

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mory of Men, and our Nights had no ways the Heat proportionate to our Days: Besides we had often sudden Changes, which tho' not so violent as in these warmer Countries; yet, had the same (tho' a slower) Effect as among them: And therefore it was, that frequent Vomiting was found so useful, which (at least in such a Degree as was found then necessary) is not always so safe. The Practice was entirely agreeable to that of these Southern Countries, and the necessity thereof will be understood when we come to speak of *Vomiting*. The same Practice obtains in Fevers, occasion'd by Surfeiting or Drunkenness; which is still to be suspected as a considerable Part of the Cause of Fevers in adult Persons in great Cities.

AND generally I should think either the above-mention'd sudden changes (which may happen a Thousand other Ways different from the Season) or a direct continu'd fit of violent Cold, or Excesses in Eating and Drinking; one or all of these, have a large Share in most of our Continual Fevers.

II. LASTLY,

II. LASTLY, it is no ways accountable from any other *Theory* (as I think) how (these Liquors which are secreted from the *Glands* at the Dissolution of Fevers, could be so different from the ordinary Fluids which are there excern'd. From ours it is evident, for an Obstruction of the *Glands* must necessarily make their respective Liquors to stagnate, which will many ways alter their Nature; but from any other *Hypothesis*, I do not see, how this can come to pass; which will lead me to consider one or two of the commonest Opinions about continual Fevers.

THE most common and generally obtaining Opinion about Fevers is, that they are more immediately produc'd by some *Morbifick* Matter; (like a Poison) which mixing and circulating with the Mass of the Blood, produces all those frightful Symptoms which we feel. This Opinion is sufficiently confuted, *Prop.* 222, 223, 224. 2^{da}. part. of *Borelli's* Book *De mot. Animal.* whether I refer the Reader; only adding (to what he has there adduced) this one Argument.

WHEN any corrupt Matter is mix'd with the Blood, so as to vitiate the whole Mass, (as Vinegar among Water) the way of curing such a Vitiating is either by forming new *Glands* to derive the vitious Part of the Mixture; or by draining the whole Mixture good and bad, and substituting new and pure Blood in it's Place; or lastly, by disposing the already form'd *Glands* to secern the corrupted Part.

THE first of these is ridiculous.

SOMETHING like the second is done, when the Blood is really vitiated in the whole; as inveterate Poxes, but that Cure cannot here have a Place, as shall be afterwards shewn.

As to the third Way, let us consider.

1. How hard it is to think (when the whole Mass is suppos'd corrupted) that the vitious Part, all at once, or in the Space of a few Hours (in which time we know, after a *Crise*, Fevers commonly leave People) should be intirely evacuated. This is not like the Actions

of Nature, which works leifurely and by Degrees.

2. LET us confider, whence all the *Glands* (at leaft the greater Part of them) fhould be fo alter'd, feeing their Configurations are fo different, and naturally they fecern fo different Liquors, as all at one Time to feparate the fame *Morbifick* Matter. And,

3. How at the *Criſe* only, and at no other Time, they fhould be fo dispos'd.

It will be very hard in any other *Theory* (in this more particularly) ſave ours, to account for theſe Things, without recurring to Miracles, or the abſurd *Metaphoric* Terms of Sympathy, Antipathy and the like. Theſe then, with what *Borelli* has brought againſt this Opinion in the forecited Places, are abundantly ſufficient to ſhew the Ridiculousneſs thereof.

BUT there are ſeveral Phyſicians, who obſerving, that, in Fevers, there was (by a Vomit) a tough viſcid Matter thrown out of the Stomach, have thought this Matter generated there, and
mix-

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mixing with the Mass of Blood, might be a considerable Part of the Cause of *Fevers*; at least might considerably augment the same; and have from thence brought Arguments for the Necessity of Vomiting in Fevers.

THIS Opinion supposes these Things.

I. THAT the Quantity of the *Morbifick* Matter excern'd by a Vomit, before the Administration thereof, was existent in the Cavity of the Stomach, after the same Manner that other Things are, which are deriv'd into the Mass of the Blood, else it could never get thither. This I shall consider when I come to speak of the Operation and Effects of Vomiting.

2. THAT it is least possible, this *Morbifick* Matter may be deriv'd into the Mass of Blood; let us at present consider this.

I know no Way, any thing of any tolerable Consistence can get into the Mass of the Blood, but by the *Lacteal Veins*. It is true, from the sudden Effects of some Spirits, Medicines, and strong

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strong Meats, we are certain, that the more refin'd Parts of these may get into the *Brain*, without going the tedious Circle of the *Lacteals*: But this is done by the reciprocal Motion of the *Nerves*, the Necessity and Mechanical Operation of which *Borelli* has demonstrated, *prop.* 155, 157, 160. 2^de. part. *De motu Animalium*. However, I think none will pretend such a Course for this viscuous *Morbifick* Matter: And therefore if it gets into the Mass of the Blood, it must go the common Road of the *Lacteals*.

To decide the Matter, I must suppose my Reader to have consider'd the 2 last *prop.* (*Ex ijs quæ ad separationes*) which *Bellini* has in his *Preface* to his Book *De Urinis & Pulsibus*, &c. and the 27, 28, and 40. of his last Book *De Motu Cordis*, &c. where the Construction of the *Glands* and the manner of Separations are demonstratively unfolded, which I take to be the noblest Discovery (in these Matters) of this Age. From these Places it is clear, that

Prop. 1. A *Gland* is nothing but a great many Complications and Circumvolutions of the *Artery* (all over the
F Coats

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Coats of which little Branchings of *Nerves* pass, design'd principally for the spiral Contortion thereof; that the Blood may be the more easily propagated thro' the same: But this is common to all the *Arteries* and *Veins*, whereby, without any Interruption of the same Spire, the Propagation of the Blood, in the former, from the Heart to the Extremities of the Body, and from the Extremities to the Heart back again, in the latter, is assisted) which sends out, from the Sides thereof, little secretory Canals, which terminate in one common Conduit, and is call'd the *Emissary* of the *Gland*; or perhaps in a common *Pelvis* (as in the *Kidneys*;) and the same *Artery* after these Windings degenerates into a *Vein*.

Prop. 2. That Separation or Secretion is perform'd by the Composition of two Motions in the Fluid; one propagated through the Length of the Canal; another transversely through its Sides (for it is demonstrable that all Fluids press *undiquaq*; and that the Direction of their Pressure is perpendicular in every Point to the Sides of the containing Vessel.) The Composition of which two is
the

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the Motion (or rather Direction) of the separated Fluid.

Prop. 3. That in a mixt Fluid, consisting of greater and lesser Cohesion of Parts, of greater and lesser Fluidity: That which has the least Cohesion and greatest Fluidity is first separated (*i. e.* is separated in the *Glands*, whose compounding *Artery* is shortest, or at least Distance from the Heart, or Fountain of Motion) and these of the next Cohesion, and next greatest Fluidity are next separated; and so on: The Distances from the Heart being in a compounded Proportion of these.

Prop. 4. That the *Intestines* are really such a *Gland*, and the most visible one in the Body; whose secretory Vessels are the *Lacteals*; and whose common Conservatory or *Pelvis* is the *Receptaculum Chyli*.

To these I shall add (because of its Affinity) the following.

Prop. 5. The Quantity separated in every *Gland*, is in a compounded Proportion of the Celerity of the Fluid at

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the respective Orifices; and of the Orifices themselves, of the separating Canals.

I shall here subjoin the Demonstration of this Proposition; referring (that of) the rest to their Author.

DEMONSTRATION.

THE Orifices being given, the Quantity separated is as the Celerities of the Fluid: For in a greater Celerity, there is a greater Quantity separated; in a less Celerity, a lesser Quantity. The Celerities being giv'n, the Quantity separated is, as the Orifices directly, for at a great Orifice there is greater Quantity separated, at a less Orifice a lesser Quantity: And therefore neither being giv'n, the Quantity separated is as the Celerities, and the Orifices conjunctly, *q. e. d.*

FROM all these I draw the following

COROL.

COROLLARIA.

1. **T**HE separated Fluids differ only in their Degrees of Cohesion and Fluidity. *per Prop. 2.*

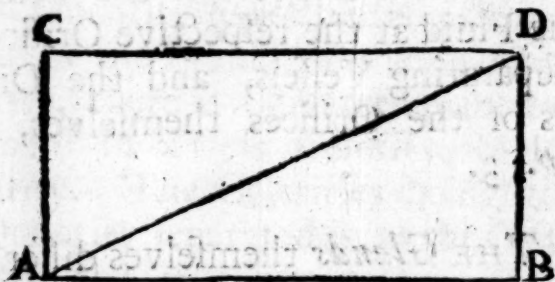
2. **T**HE Reason, why Fluids of different Degrees of Cohesion and Fluidity, are separated in such and such *Glands*, is the different Degrees of the Velocity of the Fluid at the respective Orifices of the separating Vessels, and the Differences of the Orifices themselves, *per Prop. 3.*

3. **T**HE *Glands* themselves differ only in the Length of the *Artery*, the Difference and Number of its Complications and Convolutions, *per Prop. 1.*

4. **E**ACH *Gland* (naturally and equally working) separates only the Fluid proper to its self; *i e.* peculiar to such Lengths and Complications, of such Degrees of Fluidity or Cohesion, to such Bigness or Smallness of the Orifices of the separating Canal; *per Prop. 3.* and

5. But this last is of small Consideration.

5. THAT Secretion may be perform'd the most easily that may be; the Insertion of the separating Canal ought to be at an *Angle* of 45 Degrees with the *Artery*, per *Prop.* 2. For let AB represent the *Artery* (if it makes a Right-line) or its *Tangent* (if it makes a Curve) and let the Motion of the Fluid be from A to B, the Right-line AB will likewise

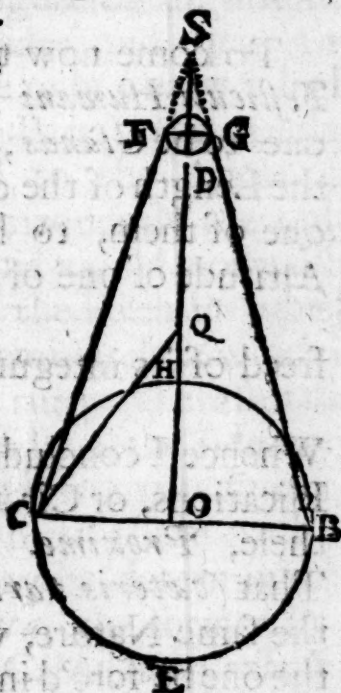


represent its Direction propagated from the Heart. Erect at A the Perpendicular AC; this will represent the Direction of the lateral Pressure of the Fluid. Compleat the Parallelogram ABCD. The Direction of the Composition of these two Motions will be the Diagonal AD, as is known; which in the present Case makes an Angle of 45 Degrees with the *Artery* AB. This were well worth the observing (if it be possible) in Animals; but it must be in live ones, before their

their Parts have alter'd their Positions. And here it were worth the examining likewise, whether what Mr. *Newton* has demonstrated (*Schol. prop. 35. lib. 2. Princip. Phil. Mathem.*) about the Resistance of *Conical* Figures, obtains in Animal Bodies; for, tho' his Demonstration be only concerning *Convex Cones*, yet the same obtains in *Concave* ones; wherefore seeing the *Artery* betwixt any two *Branchings* is a *Conus truncatus*, it may be represented by the Figure *CEBGF*;

now seeing the Diameter *CB* of the Base of this *Conus truncatus*, and the Diameter *FG* of the Base *FDG* of the *Conus abscissus* *FDGS*, as likewise their Distance, *OD*, may all be had; it is evident, that the intire Cone *CBGSH* may be had likewise:

Wherefore bisect the Distance *OD* in *Q*; and if it be found (having drawn *CQ*) that *QS* is equal to *QC*, then the *Conus truncatus* *CEBGF* (among all of the



same Base and Altitude) gives the least Resistance to the Blood flowing from O to D. I am inclin'd to think this may obtain in the Trunks of the great *Arteries*, betwixt their branchings; (for no further is to be considered.) This I recommend to be examin'd for the Honour of that great Man, who has crouded up in this *Scholium* (not to mention the rest of his admirable Book) a vast number (if retail'd) of most charming and useful Truths.

To come now to the Business; The *Testiculi Humani* are granted by every one to be *Glands*; and *Bellini* has found the Length of the complicated *Artery* in one of them, to be 300 Ells, and the Altitude of one of these *Glands*, (when freed of its integuments) to be $\frac{1}{16}$ Ell :

Whence I conclude, there must be 4800 Plications, or Circumvolutions in one of these, *Proxime*. He likewise asserts, That (*ceteris paribus*) if two Fluids of the same Nature, with equal Velocities, the one be forc'd into a Canal of the same Number and Lengths of Complications, as are in the foresaid *Gland*, and the o-
ther

ther into a strait Canal of the same Length; the Velocity (in or about their *Exits*) of the first Fluid, to that of the second, will be as 1 to 4800. He has not indeed subjoin'd the Demonstration, but if we suppose the *Artery* to lye in *Plicæ* or Folds of such Number and Lengths, as we have just now determin'd; (which is perhaps not far from truth :) And we suppose the Turnings of the *Plicæ* to be circular; (which perhaps may follow from this, That seeing a Circle is the only ordinate Figure of an infinite Number of equal Sides, and equal Angles; it must be the only *Curve* which can make (in all its Parts) the Angles of *Incidence* equal to the Angle of *Reflection*, and consequently the only *Curve* in which a Fluid would most easily turn) and likewise the Arch in which they turn to be a Semi-circle; (which it must be, if the Sides run parallel after the turning; and universally, if the Sides produc'd make any Angle from the Quantity thereof, the Quantity of the Arch in which they turn may be determin'd.) I say, from these *Data*, the former Proportion may be by Calculation examined; or perhaps, more briefly by Experiment, thus,

TAKE

TAKE a Pipe of Metal of any Diameter, and fold it into any determin'd Number of *Plice*, whose Sides may run Parallel, and whose Lengths may be

$\frac{1}{16}$ Ell: Then, by a Weight, force a Li-

quor through it, and observe the Time betwixt the first Entery of the Liquor into the complicated Canal, and its first Appearance at the other Orifice; then take another strait one of the same Length with the former, and with the same Weight force the Fluid through it, observing the same Way, the Time of its Passage, the Lengths being the same, the Velocities shall be as the Time of passing reciprocally, as is known. Having thus got the Proportion of their Velocities in any one determin'd Number of *Plice*, we may (by the Rule of *Three*) have their Proportions, in any assign'd Number thereof. Supposing then that this great Man has found the Truth of the foresaid Proportion from some such Way, as one of these; it follows, that in every turning, the Velocity

ty must be abated $\frac{1}{4800}$ of the whole Pro-
 xime: (for $4800 : \frac{4800}{4800} :: 4800$ 1.) Now

let us suppose the Proportion of the Cohesion, and Fluidity of the Fluid separated in the *Testiculi Humani*, to the Cohesion and Fluidity in our *Morbisick* Matter, now deriv'd from the Stomach into the small *Intestines*, to be as 1 to 2. (I mean the Cohesion and Fluidity of the Fluid separated in the *Testiculi Humani*, as it is when immediately separated. For when it has lodg'd any Time in the *Vesiculae spermaticae*, we know by its Ebullitions and the Evaporation of its thinner Parts, it loses a great deal of its Fluidity.) And that this is a liberal Allowance is evident from *Leuwenhoek's* Experiments scatter'd up and down the *Phil. Transf.* and printed all together at *Amsterdam*; where we may see from the *Microscopical* Observations he has made on this Fluid, its Fluidity is little less than that of common Water: And consequently, at least, ten Times more than that of our *Morbisick* Matter.

AND

AND here I hope it will not be impertinent, to set down a Proposition to compare the Viscidities of different Liquors.

PROPOSITION.

LET two Drops of two different Liquors fall into a Pair of fine Scales; (a Drop of the one Liquor into the one Scale, and a Drop of the other Liquor into the other Scale) so that there fall no more than just their own Gravities carry down: Thus you shall have, what I here call, their comparative Gravities: and by the ordinary Method you may likewise have their Specifick Gravities. These being given; I say, their Viscidity and Cohesion shall be in a compounded Proportion of their Specifick Gravities reciprocally, and their comparative Gravities directly. The Demonstration is easie from the Nature of Fluids.

LET us again suppose the Length of the small Guts, (for it is there only where any Thing is separated from the

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Intestines) to be 6 Yards; and that in every $\frac{1}{16}$ of a Yard, there is a Plication: (And that these are likewise liberal Allowances; any who have ever seen a Dissection will know.) Then there will be 96 Plications in the whole; and consequently the Fluid in these *Intestines* will lose but 96 Parts of the whole Celerity it had at its Entry.

Lastly, Let us suppose that Celerity to be equal to the Celerity of the Blood, when it first enters the Plications of the *Testiculus Humanus*; (which all will readily grant, who consider, that there is never any Thing found in these small Guts, but a thin Liquor in a wide Canal, thrust forward by the Force of the *Fibres* of the Stomach and *Intestines*.) Let us call this Celerity *a*.

Now from *Corol.* 1, 2, and 3. about Separation; if a Viscidity, as 1 gives 4800 Plications, then a Viscidity as 2 will give 9600 such: And therefore, that such a viscid Liquor should be separated, it is requisite it should lose 9600 Parts of the whole Celerity: But (as has been just

now

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now shown) by the *Plica* of the *Intestines*, the Fluid will lose but 96 Parts of the Celerity *a*. Whence it is absolutely impossible that the *Intestines* should separate this viscid Matter, unless they were a hundred Times longer than they are: For $96 : 9600 :: 1 : 100$. If the Viscidity of the Fluid, separated in the *Testiculus Humanus*, were to that of our *Morbifick* as 1 to 10, then the small *Intestines* ought to be five hundred Times longer than they are. And indeed I believe the Proportion really not to be under 1 to 50; and then they ought to be at least 25 hundred Times longer than they are.

THUS we see the second Thing (this Opinion supposes) is false; and indeed, it hardly could be otherwise; for, (in my Opinion) the *Feces* themselves might more probably get into the Mass of the Blood, than this viscid Matter, the Parts of these being only united by a simple Contact: Whereas the Parts of this are joyn'd by a very strong *Nisus*. And I remember, Dr. *Lister*, some-where in the *Phil. Transf.* relates how he try'd to get in a very fine ting'd Spirit into the *Lacteals* of a live *Dog*, by curing the small
Guts,

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Guts, and injecting the Liquor, then sewing up all again: But he cou'd never get it done to his Satisfaction. And here it is to be observ'd, that People may be deceiv'd with blue Tinctures; for this is the Natural Colour of these *Lacteals* when they are almost, or altogether empty.

IF it be objected, 1. That the Concoction of the Stomach and *Intestines* may fit this *Morbifick* Matter, to be separated by the *Lacteals*. 2. That the *Peristaltick* Motion and the *Valves* of the *Intestines* may hinder the quick Motion of the compounded *Chylous* Matter. 3. That there are some Medicaments, as *Turpentine*, &c. which we know, by their Effects, get into the Mass of the Blood, and yet are more viscid than our *Morbifick* Matter. 4. That there is really as viscid Matter separated in some other *Glands*, as the *Bile* and the *Phlegm*.

To these I answer,

1. As to the first; seeing *Triture* is the only Effect of the Stomach and *Intestines*, there is no Advantage to be reap'd

reap'd thence; for no beating nor grating will dissolve the Union of this *Morbifick* Matter. Besides, where it is in any Plenty, the Effects of Concoction are very small, or none.

2. As to the Second; The *Peristaltick* Motion being reciprocal, it adds as much (to the Motion of the *Chylous* Matter) in its Descent towards the *Rectum*, as it takes away, in its Ascent towards the Stomach; and so cannot serve that End, the *Plicæ* and Circumvolutions of these *Intestines* (which we have consider'd) being only to be rely'd on for this Purpose. As to the *Valves*, we know they all open toward the *Rectum*, and serve only to stop the Ascent of the *Fæces* in the *Peristaltick* Motion, and so cannot retard the Motion of the *Chylous* Matter.

3. As to the Third; we likewise know, that all these Medicaments are dissolv'd into a thin Liquor by Heat (as *Turpentine*, Butter, &c.) Besides that only the most spiritous and least viscid Parts enter the Blood; which is not said of our *Morbifick* Matter.

4. As

4. As to the last; There is a great Difference betwixt a Liquor immediately after it is separated, and when it has Stagnated sometime in the Conservatory of the *Gland*; for then the aqueous and more humid Parts evaporate; and by its Stagnation it acquires an ineptitude to Motion: And tho' the Blood flows very easily in the *Arteries* and *Veins*; yet I defy any to cause extravasated Blood to enter its Vessels again. But more particularly, we must consider the *Liver* to be a very large Vessel, and (if it were evolv'd) to make an *Artery* many thousand Times longer than that of the Canal of the small *Intestines*, or *Testiculus Humanus* either; and so it is no wonder if it separates a viscid Matter; the Motion of the Blood there being very small: But still I assert it is not near so viscid as our *Morbific* Matter is. As to the *Phlegm*, we know it is not naturally produc'd; and the *Morbific* Matter it self (against which we dispute) might be as well objected; for it is only the Stagnation, Corruption and Evacuation of the Humidity, which occasions both; the same might be said of the Purulent Matter which passes by *Urine*, but that we know

it proceeds from an *Ulcer* in the *Kidney*, or Neck of the *Bladder*, and is not discerned with the *Urine*.

HAVING dwelt thus long on the Opinions of others, I come now to consider the proper Remedies of Fevers, which I reduce to, 1. *Blood-letting*. 2. *Vomiting*. 3. *Purging*. And, 4. The *Medicaments* which increase the less *sensible Evacuations*; under which Head I comprehend Sweating, Perspiration, and the like.

I do not here consider Blistering and outward Applications; seeing (in my Opinion) they are only useful to remove the accidental Effects, and not the Cause of Fevers, without which they cannot be said to be truly cur'd.

1. As for *Blood-letting*; The Subject is so fully and learnedly treated by *Belini* in his foremention'd Books together; that it were equally impossible as impudent to offer at any Additions: And therefore for intire Satisfaction on this Head, I shall refer my Reader to these Books.

2. As

2. As to *Vomiting*; I shall comprehend all I have design'd to say about it in these Particulars. 1. I shall show that Vomiting is partly produc'd by the *vis stimulans Vomitorii*: But, 2. That is mostly occasion'd by the *vis stimulans* of the *Morbific* Matter excern'd from the *Glands* of the Stomach. 3. I shall prove that this *Morbific* Matter is not in the Cavity of the Stomach (at least in such Plenty as it is excern'd by a forc'd Vomit) before the ingestion of the said Vomit. 4. I shall give the whole Destruction and Connexion of this Operation; And, 5. Shall consider the Advantages of the same in the Cure of Fevers.

BEFORE I come to handle these, it is necessary, I first explain what I here mean by a *vis stimulans*.

By a *vis stimulans*, I understand such Quality in a Fluid, whereby the Particles thereof are dispos'd to make a real Division or a violent Inflexion of the *Nervous* and *Membranous Fibres* of the Body, which occasions frequent and forcible Reciprocations, Successions,

and Derivations of the *Liquidum Nervorum* into the *Muscles* and contractile *Fibres* of the Canals; whereby all the involuntary *Muscles* are brought into violent Contractions, and the Emissaries of the *Glands* are squeez'd.

THOSE who desire a fuller Account of the Nature and Mechanical Operations of this *vis stimulans*, may see it, *Pag.* 165. &c. of *Bellini's Book De Urinis & Puls. & Prop.* 52. of his last Book *De Motu Cordis*. I say then,

1. *Vomiting* is *Partly* produc'd by this *vis stimulans Vomitorii*; This is evident from these Considerations. 1. Because sometimes we immediately *Vomit* upon the Ingestion of the *Vomitory*, before the *Morbific* Matter excern'd from the *Glands* of the Stomach could have time to concur. 2. We throw up very often the same we had taken in, with little or no Mixture; which could not happen, if the *Morbific* Matter had concur'd to produce the Fit. 3. Sound Persons (in whose Stomachs there is little or none of this *Morbific* Matter) often *Vomit* upon a too plentiful ingestion of an (otherwise) inoffensive *Liquor*. The only

only Reason of which must be, that the Stomach not being able to derive into the Mass of the Blood the said Liquor, so fast as it is pour'd in, it must sower on the Stomach, and thereby acquire this *vis stimulans*, whereby it is thrown out: Or perhaps it may still have a *vis stimulans*, tho' not (when it is in a small Quantity) sufficient to bring the Stomach into that violent Contraction which is necessary in Vomiting; But this small *vis stimulans* being multiply'd by the too great Quantity of the Liquor, may acquire sufficient Force to produce the Effect; as we see several things lose the Quality to produce their visible Effects, when in small, which they had when in great. But, 2.

I say, Vomiting is mostly occasion'd by this *vis stimulans* of the *Morbific* Matter excern'd from the *Glands* of the Stomach; and that for these Reasons, 1. The Action of the *vis stimulans Vomitarii* being terminated at, or near the internal Surface of the Stomach, after one or two plentiful Fits of Vomiting, (there being produced thereby such a Succussion and Compression of the Sides of the Stomach) these *Particule Stimulantes*

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must necessarily be disentangled; and so there could be no more Fits of Vomiting, which is contrary to Experience.

2. We evidently see in Sea-vomits, and in those produc'd by the Joltings of a Coach in some People, there is no *vis stimulan Vomitorii* to which we can attribute this Effect; and therefore it must necessarily be produc'd by the vellications of the Morbific Matter excern'd by this particular Motion. The Manner of which may be thus explain'd, every particular Body has a determin'd Degree of Tension, and a determin'd Length. And if a like Reciprocation of Motion (by whatsoever cause) be produc'd in the ambient *Medium*, which would necessarily be produc'd by another Body (when mov'd) of the same Degree of Tension, and of Length commensurable to the Length of the first Body, there must be of necessity a Motion produc'd in that first Body, especially if the Motion of the *Medium* be violent, and the commensurable Lengths be as the first Numbers of the ordinary Arithmetical Progression, 1. to 2. or 1. to 3. or 2. to 3, &c. This is evident in the unisone or concordant Strings of greater Musical Instruments: And the Reason is, because

cause thereby the *Oscillations* of such Bodies become Commensurable. Now I suppose this particular Motion of Jolting Coaches and Ships, to be such, as would be produc'd by another Body, having the just now mention'd Analogy to the *Nerves* of the *Glands* of the Stomach, whereby they are brought into Motion, and consequently derive great Plenty of their *Liquidum* into the Places, which makes such Contractions as squeeze these *Glands* of the matter, which produces these Fits of Vomiting: Besides, that the same cause may (upon other *Fibres*) produce the antecedent Sickneſs which we feel in Sea-Vomits. 3. By a Vomit of warm Water (for example) there are often produced ſeveral Fits of Vomiting; and yet we all know there is no *vis ſtimulans* in it; So that all it can do, is, that by its warmth (which is a kind of a *Fotus*) it elicits the Matter from the *Glands* of the Stomach, which Occaſions this Vomiting. I could add a great deal more to confirm this Propoſition, but I think this ſufficient. I ſay,

3dly, THAT the *Morbific* matter (excern'd by Vomiting) is not exiſtent in the Cavity of the Stomach, (at leaſt in ſuch Plenty, as it is excern'd by a forc'd Vomit)

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Vomit) before the Administration thereof. 1. This is an evident Corollary from the former *Prop.* The Vomit does not act (at least after the first one or two Fits) by it's own *vis stimulans*; there is (in Vomiting) produc'd a violent Contraction of the *Fibres* of the Stomach, the *Muscles* of the *Abdomen* and *Diaphragm*, which must be occasioned some Way. There is nothing (in Vomiting) which can Occasion this, but either the *vis stimulans Vomitorii*, or of the excern'd *Morbific* Matter; and since (as has been already proved) it can not be the former, it must of necessity be the latter: Wherefore if the *Morbific* Matter were already existent in the Cavity of the Stomach, the Vomit were of little use after one or two Fits; which is contrary to Experience. 2. If this *Morbific* Matter were already in the Cavity of the Stomach, it is not possible, but that one or two plentiful Fits of Vomiting, would eject all that is there; so that afterward there should none be thrown out, however violent the consequent Fits were, which is likewise contrary to Experience. The Force of the *Muscular Fibres* of the Stomach, the *Muscles* of the *Abdomen* and *Diaphragm* (which two last Monsieur

Chirac,

Chirac, Professor of Medicine at Montpellier, by an easy Experiment, has shewn to concur principally in Vomiting. *vide, The Preface of Tournfort's Histoire des Plants qui Naissent aux environs de Paris*) is at least equal to 260000 lib. Weight; (the Force, of the *Muscles* of the *Abdomen* and *Diaphragm* being more than that of 248000 *libs.* and of the Stomach, not inferior to that of 12000 Pounds) which Force if it be not sufficient to drive out all that is existent in the Cavity of the Stomach (however Viscid the Matter be) I leave every one to judge. 3. Supposing the *Morbific* Matter already in the Cavity of the Stomach; It is Impossible to give an Account of the different effects of different Vomits: For Example, why an *Antimonial* Vomit does excern this *Morbific* Matter more plentifully than Whey or warm Water. For if before the Ingestion of either, the *Morbific* Matter is already in the Stomach, then the only thing left for them to do, is, to excite the Act of Vomiting: But it is certain they may be both brought to be equal in that, *i. e.* they may be both brought to excite an equal Number of Fits of Vomiting; and that with equal violence (by taking their

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Quantities in a reciprocal Proportion to their Vomitive Faculties) And yet their Effects be very different, otherwise I omit (for avoiding tediousness) the other arguments I can produce to confirm this Proposition.

4thly, THE whole Deduction and Connexion of this Operation is thus: The Particles of the Vomitory by their *Incuniation* into the Orifices of the *Emissaries* of the *Glands*, adjacent to the Surface of the Stomach, do dilate the same (which by some extrinsic cause) had been contracted, and after the same Manner do dissolve (at least in some Degree) the Cohesion of the stagnant *Morbific* matter, and render it more Fluid; and consequently, its Resistance less: Now, the natural and constant Action of the *Glands* being Secretion; and the *Impedimentum* (by the Dilatation of the Orifice and Attenuation of the Fluid) being totally taken away, or (at least) made less than the natural *Momentum* of the *Glands*; the Matter must necessarily flow into the Cavity of the Stomach, till it be accumulated in such a Quantity (which not being to be done in an Instant, must require some Time) as is sufficient

sufficient (by the united loathsomeness and the *vis stimulans* of it, and the Vomitory) to vellicate and force the *Fibres* of the Stomach, *Abdomen* and *Diaphragm* by the Communication of the *Nerves* of the first with the two last) into a violent Contraction, and thereby throw all out by the *Oesophagus*, which brings all to quiet again, till there be a new, a sufficient Quantity excerned from these *Glands* to reproduce the foresaid Contraction: And thus there happens a Fit of Vomiting and Quiet alternately, till either all the *Morbific* Matter be thrown out, or the Force of the Vomit so diluted, that it's no longer able to elicit the *Morbific* Matter from the *Glands*. Besides these Primary effects of Vomiting, there are two others, which ought not (tho' less principal) to be omitted. The first is, that in a strong Vomit, or in one which requires some considerable Time before it operates, there often passes some part thereof from the Stomach into the *Intestines*, and occasions a gentle Purge, by dissolving the *Fæces*, and vellicating the *Fibres* of the *Intestines*, as shall be more particularly shown when we speak of *Purging*. However the Effects of this, Purge very seldom, or never go beyond

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beyond the *Prima Viæ*; for all gentle Purges (of which this is one) are confined within these. The second is, that the strong Contraction in so many *Muscles* and *Muscular* Canals, which are at Work in Vomiting, and the violent Concussion which is produc'd over the whole Body, by a Power (as has been said) which is not inferior to that of two Hundred and Sixty Thousand Weight, may and often does, take away the Obstructions in many other Canals, than those which are more immediately concerned about the Stomach and *Oesophagus*, as we evidently see by that vast Sweat which always breaks out after plentiful Fits of Vomiting. From these I deduce,

5thly, The Advantages of Vomiting in the *Cure* of Fevers; which are, 1. The taking away the Obstructions of the *Glands* of the Stomach, and (sometimes) of the *Intestines*, which is the principal use of vomiting; and how great a Step this is toward the Cure of Fevers, every one will see who considers, that in Fevers occasion'd by Intemperance, the Stomach is the Scene where this great Mischief is both contrived, and put into Execution;

cution; the Obstruction of the *Glands* thereof, being the first and principal Cause of these Fevers; and in Fevers occasion'd by Cold, the Stomach and *Intestines* being most expos'd, and least defended from the Cold Air, receives its first and strongest Impressions; which two (as formerly was said) have the most considerable Share in the Cause of our continual Fevers; And therefore it is, that Vomiting (being timely and plentifully us'd) very often prevents such Fevers. 2. Another Advantage of Vomiting is, that by the strong Contraction of the *Muscle* and *Muscular* Canals and the violent Concussions of the whole Body thereby produc'd the Obstructions of many other *Glands* are remov'd, as has been just now shown.) so that this with the former (removing so considerable a part of the Cause, enables Nature to perform the rest very easily. 3. A third Convenience (if not Advantage) of Vomiting, is, That it is less dangerous than many of the Medicaments that are taken inwardly; The Effects of this is confin'd to the *Primæ viæ*; (by which I always mean that winding Canal, which is continued from the Mouth to the *Sphincter ani*,) and is
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consequently less dangerous than those which run the Circle of the Blood; for it is not to be doubted, that all alterative Medicines have more or less Danger in them (from the Effect of their Stimulations upon the *Nerves*, their Fermentations with the Blood, their separating, or promoting the natural Cohesions of the Liquors of the Body, and their many other unknown Productions.) That which goes the least way, must therefore have the least Danger: Now, since it is certain, that Vomiting does not go out of the Stomach and *Intestines* (where the Canals are strong and wide, and the Fluids are viscid and gross) there must of Necessity be less Danger in it, than in these which enter into narrower and weaker Canals fill'd with more Fluid and finer Liquors. It is true indeed, there is some Hazard from the bursting of the Capillary Vessels of the internal Surfaces, by the violent Concussion of the Body, occasioned by Vomiting; but this is easily prevented by Blood-letting which ought always to precede the plentiful use of Vomitories in all Diseases. Besides, sometimes the Violence of the Vomit, is too great for the Strength of the Patient; but this is rather

rather the Fault of the Physician than the Physick: For the Strength, and (consequently the Violence of Vomits, as of all other Medicines) ought to be adjusted by this Proportion, *viz.* They ought to be in a compounded Proportion of the Strength of the Patient, and the Danger of the Disease. If this were observed, none cou'd ever err in the Administration of Medicines.

III. COME we now to that which we call'd the third proper Remedy of Fevers, to wit, *Purging*; In explaining of which, I shall, 1. Shew that vomitive and purgative Medicines differ only in Degrees of the same Quality. 2. I shall give a short Account of the several Steps, and of the Manner of this Operation. And, 3. Consider its use in the Cure of Fevers. I say then,

1. That vomitive and purgative Medicines, differ only in the Degrees of the same Quality, *i. e.* Purgative Medicines, by increasing their Force vastly, and confining it to a lesser Quantity, either of a Fluid or solid Body, become Vomitive, and vomitive Medicines (if diluted) become Purgative. This will be evident from these Considerations.

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1. We find by Experience, a strong Purge never misses (if either it be very strong, or the Patient not very strong) to Vomit, and the weaker Part of a Vomit, which escapes into the *Intestines*, does frequently Purge us. 2. The same Medicines (for Example, *Vinum Emeticum*,) taken by the Mouth, will provoke Vomiting, which given by way of *Glisters*, will purge: The same obtains in all strong *Emetics*. In short, all strong Medicines of either kind constantly produce both these Effects. The Reason of all which is this; if the Medicament of either kind be so strong as immediately to vellicate and stimulate the *Fibres* of the Stomach, to dilate the Orifice, and attenuate the Matter contain'd in the *Glands* thereof, it produces Vomiting; if it act but gently, so as only to assist the natural Motion of Digestion, it goes by the *Intestines*, and dissolves the Cohesion of the *Fæces*, and finding there more sensible *Fibres*, is able to bring them into violent Motions, which produce Purging, as shall be just now shown. 3. It is impossible in any other *Theory*, to account how these two different Medicines, shou'd upon the same Parts produce different Effects; For both these Medicines are taken by the Mouth,

Mouth, go down the *Oesophagus*, and enter into the Stomach, either in the Form of a *Liquid*, or are there by it reduced into a *Liquid*; and consequently are brought into contact with, and operate on the same *Fibres*, *Glands* and *Membranes*; and yet produce (by their Assistance) two different Effects. It is simply impossible to explain the Manner of this, without saying the one acts more powerfully and forcibly, and makes more violent Contractions, and consequently is thrown up the most patent way; the other more gently and softly, and has thereby time to seek out the less obvious Passages.

2dly, THE Account of the several Steps, and of the Manner of this Operation, is thus; Purgative Medicines, being received into the Mouth, and admitted into the Stomach, their Particles vellicate and stimulate the *Fibres* thereof, and thereby encrease the digestive Faculties, *i. e.* bring the *Muscular Fibres* of the Stomach, the *Muscles* of the *Abdomen* and *Diaphragm* into more frequent Contractions than ordinary, 'till they are admitted into the *Intestines*, the *Fibres* and *Glands* of which being more sensible

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than those of the Stomach (whose Parts by the frequent rough Contacts, of one against another, and of the gross Bodies which are often thrown into it, are as it were dead'ned) they easily move and bring into frequent and forcible Contractions, whereby these *Glands* are squeez'd of a Fluid, which lubricates the Passages; and mixing with the feculent Matter of the *Intestines* (which is rendred Fluid by the same active and stimulating Quality of the purgative Medicine) renders it yet more Fluid, by which (and by the more than ordinary Contractions of the *Intestines*) it passes more plentifully and easily into the *Rectum*, and is thence ejected. This is the use of the more gentle Purges which only cleanse the *Intestines*. But those of more Force (besides all these) do (as to the greater and more spirituous part) enter into the Mass of the Blood by the *Lacteals*, and mixing therewith produce many unnatural Fermentations therein, separating or promoting the natural Cohesions of the Liquors of the Body, and occasioning many other unknown effects, as has been formerly said: And likewise there, vellicating the spiral *Fibres* of the *Arteries* and *Veins*, bring these into more forcible

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Contractions, and thereby promote the Circulation of the Blood, and make it run with greater Velocity and Force; and by this Means in a short Time wash away any Obstructions that either happen to be in the more direct *Arteries*, or the more complicated ones which constitute the *Glands*, encrease the insensible Perspiration, and purify the Blood of all the grosser and more noxious Parts, by the *Ductus Chylodochus* and *Pancreaticus*, which void themselves into the *Intestines*. All these Effects of the more powerful purgatives are visible; for sometime after one has taken such a strong Purge, we find the Pulse mightily encreas'd, the Perspiration augmented, the Spirits, or *Liquidum Nervorum* spent, the visible Excretions by Siege and Urine much greater, and the Body weaken'd; especially after a few Days of such a Course. Whereby it is evident these Medicines must operate after the Manner now explained. From hence it is clear,

3dly, THAT the Advantages of Purg-
ing in the Cure of Fevers are very great,
upon these two Considerations. 1. If
the Purge be more gentle, so that it only

serves to cleanse the *Intestines*, it partly takes away the Obstruction of the *Glands* of the Stomach, and totally that of the *Glands* of the *Intestines*; which is a considerable Step towards the Cure. But, 2. If the Purge be more violent, so that it enter in any Plenty into the Mass of the Blood, it conduces so much toward the Removal of the Obstructions of most of the other *Glands*, that Nature is able to perform the rest very easily her self. But alas! This Case has so much Danger, and so many Inconveniencies in it, as render it as unsafe as otherwise (if these could be removed) it would be useful. *Bellini*, in his Book *De Urinis & Pulsibus*, pag. 222. has demonstrated, that in violent Purges there is a greater Danger by far than in Blood-letting. His Words are, "*Quia vero quicquid est*
 "*suspicionis in missione Sanguinis ad so-*
 "*lum fermentationem non naturalem, qui*
 "*possibilis per ipsam est in reliquo Sanguine*
 "*redigitur, & hoc uno de nomine periculo*
 "*non vacat; si igitur hujus mali suspicione*
 "*careret purgatio, illa potius adhibenda,*
 "*quam venæ-sectio; cum purgatio ejus loco*
 "*cæteroquin esse possit: sed res e converso*
 "*se habet, suspicio enim ejus mali a missio-*
 "*ne Sanguinis est suspicio rei possibilis non*
 "*tamen*

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“ *tamen necessario provenientis, aut neces-*
“ *sario conjunctæ, cum qualibet missione*
“ *Sanguinis; in purgatione autem necessa-*
“ *rium semper est Sanguinem solvi a natu-*
“ *ralibus CohæSIONIBUS, seu recedere & di-*
“ *moveri a sua compositione; In Purga-*
“ *tione igitur periculum erit certum, in ve-*
“ *næ-sectione dubium: hoc est, erit Pur-*
“ *gatio venæ-sectione periculosior, &c.* ”

And there he goes on to shew how much more dangerous Purging is than Blood-letting. From this, and a great deal more, he has there adduc'd, it is evident, 1. That violent Purges have a great deal of real Danger in them absolutely, without respect to other Remedies; and these unnatural Fermentations and Changes of the Cohesion of the Fluids, instead of promoting the Cure, often increases the Cause of Fevers, to wit, the Obstruction of the *Arteries* which constitute the *Glands*. 2. That violent Purges are respectively much more dangerous than Blood-letting; wherefore this last is a more safe, and consequently a more useful Expedient in the Cure of Fevers, than the former. And I say, 3. That violent Purges are a much more dangerous Remedy in Fevers, than Vomitings are; for Vomits extend no farther than the *Primæ*

Via, where Canals are strong and wide, the Fluid viscid and gross; but violent Purges reach all the slender Vessels and noble Liquors of the Body, where the Danger of any considerable Alteration is extremely great. Wherefore upon this Account, I say, that the Danger of violent Purges is to that of Vomiting, as the Length of the Canals of the whole Circuit of the Blood, is to the Length of the Canals of the *Primæ Viæ*. And how much longer the first is than the latter, I leave the Reader to consider. Besides all these, there are so many other known and evident Dangers in violent Purges, that the only Part of Purging, which is safe (in curing Fevers) is *Glistering*, or the *Lotiones Alvi*, or rather than either of these, only that gentle Purge, which is the concomitant of every plentiful *Vomiting*.

IV. We are come now to the last proper Remedy of Fevers, which was the *Medicaments which encrease the less sensible Evacuations*. But all that can be pertinently said on this Head; is so learnedly and accurately already handled in a Treatise entituled, *Archibaldi Pitcar-nii Dissertatio de Curatione febrium, quæ per*

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per Evacuaciones instituitur, that thither I shall refer the Reader, only adding the Reason why such Medicaments administered in the Beginning of Fevers, do rather increase than cure them, which is this: In an Obstruction of the *Glands*, the Blood in the complicated *Arteries* which constitutes the same, stagnates up to the next Branching thereof, nearest the Heart; and thereby a considerable Length thereof becomes obstructed and unpassable; the only way this Obstruction can be removed is by the Force of the Blood, which in every Pulse or Contraction of the Heart, washes off a Particle of the same till the whole be dig'd away; as shall be shown. Now the *Arteries* which constitute the *Glands*, whereby the insensible Evacuations are naturally secern'd, being in the beginning of the Fever so much obstructed; it is simply impossible for such Medicaments to carry these Obstructions off as they are just now; they must rather force through the superficial *Arteries*, and those few other *Glands*, that are (perhaps) left passable, the natural Humidity only, *i. e.* the thinnest Parts of the Blood, and consequently make it more viscid, and thereby the Obstruction more firm, *i. e.* will

increase the Fever; whereas, when a great deal of these Obstructions in the *Arteries* are wash'd away by the Force of the Blood; *i. e.* in or near the Decline of these Fevers, such Medicaments will be able to force the small Remainder of these Obstructions either through the Orifice of the *Gland*, or into the continued *Vein*, 'till, by frequent Circulations, it be either lost, or thrown out of the Body.

FROM all that has hitherto been said about the Cure of these Fevers, it is evident.

COROLLARIA.

I. **T**HAT the first Thing incumbent upon a Physician, in the Case of these Fevers, is to let a considerable Quantity of Blood, both in order to remove the Cause of these Fevers, and to prevent the Inconveniencies of the subsequent Vomiting. *Bellini* in *Prop. 5.* and *6. De Febris* has demonstrated, that
" Vena in omni morbo est secanda, in qua
" minuenda quantitas, aut augenda velo-
" citas, aut refrigerandum aut humectan-
" dum, aut aliquid adhaerens vasis dimo-
" vendum

"*vendum aut abripiendum.*" Than which there cou'd be nothing more par to our Theory.

2. THE second step in the Cure of these Fevers is Vomiting; for it at least removes the Obstructions of the Stomach and *Intestines*, and goes a great Length to take away the Obstructions of the other *Glands* likewise. This especially obtains in Fevers occasion'd by Intemperance or Cold: As is evident from what we have said about Vomiting; but as for Purging in Fevers, there is very little more safe than what is the necessary Concomitant of all such Vomitings.

3 THE last, but most universal, and surest Step, is the increasing the less sensible Evacuations: But this must be used only in the decline of these Fevers, as has been just now shewn.

I have in this Place only determin'd the Order, and the several Degrees of the Efficacy of these Remedies (in the Cure of Fevers) with respect to one another: Their Kinds and Quantities being to be adjust'd by a former Analogy, I have given

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en, when I was speaking about the Advantages of Vomiting.

BUT here it may be very fairly ask'd, why (since I make the Obstructions of the *Artery* and *Nerve* which constitute the *Glands*, the principal Cause of Fevers) do not I allow Mercurial Medicines (which all grant to be one of the most proper, and perhaps *Specific* Remedies of Obstructions) to be one of the Steps of the Cure of these Fevers?

BEFORE I answer this Question, I shall, 1. Explain the Nature of Mercury. 2. I shall shew the Manner of the Operation of these Medicines; and, 3. The Advantages and usefulness of them.

I. *As to the first I suppose,*

1. THAT pure Mercury, or Quick-silver, consists of Parts (I mean those of the first Composition, by which I understand an aggregate of the smallest and least constituent Particles of any Body, and an Aggregate of these Aggregates I call of the second Composition; and so on) exceedingly small, equal, and perfectly Spherical.

THIS

THIS has been suppos'd by all who have written any thing tolerable about the Nature of this Mineral. It is true indeed, some have suppos'd it so, because they saw that dividing Mercury upon a plain (even by the Assistance of a Microscope) still the upper Part retain'd its Sphericity, which they could not so easily observe in other Fluids: But the true Reason of this is, The great Gravity of the Mercury, in respect of other Fluids, and the uniform Pressure of the Medium. For all Fluids will retain their Sphericity till their Quantity be so diminish'd (either by their being another Heterogeneous specifically lighter Body included in them, or by their Gravity decreasing at a greater rate than their Surfaces) that they of equal Gravity with unequal Portion of the Medium they are in, and then they will receive any Figure the Motion of the Medium can imprint on them. However the Divisions of Mercury must be very small, before it can be reduc'd to this State; but that it can at last be brought to it, is evident from the mixing and pounding of Quick-silver among common Water in which we know a
Part

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Part of the Quick-silver is lost, by the Diminution of its Weight, and the discolouring and Effects of this Water.

BUT the true Reason why the former Supposition is to be made, is, because from it some of the Phænomena of Mercury may be accounted for:

FOR, from thence it is evident, why Mercury (tho' the heaviest known Fluid) rises with fewer Degrees of Heat in an Alembick, than any other. 1. Its parts (of the first Composition) being exceedingly small, *i.e.* smaller than such parts of any other Fluid, it must rise sooner than they; because the Gravity of its Particles has a lesser Proportion to their Surfaces, than the Gravity of the Particles of any other Fluid has to their Surfaces; for the Gravities of Bodies decrease in a Triplicate Proportion, whereas their Surfaces decrease only in a Duplicate one. Thus supposing (for Example) the Diameter of a Particle of Mercury (of the first Composition) to be to the Diameter of a Particle of Water (of the same Composition,) As 2 to 300; (and we may justly suppose the Odds infinitely greater) their Surfaces will be

as

as 4 to 90000. And their Solidities, *i. e.* their Gravities, as 8 to 27000000. This upon Supposition their Specific Gravities were equal; but supposing (at the largest) the Specific Gravity of Mercury to that of Water, at 13 to 1. The real Gravities of such Particles will be to one another, as 120 to 27000000: Whence it is evident, that not only the *ratio* of 8 to 4, or 2 to 1. is much less than that of 27000000 to 90000 or 300 to 1. And therefore upon such Supposition it will follow, That the Gravities of such Particles of Mercury, wou'd be much less than that of such Particles of Water: And that the Surfaces of these Particles of Mercury, wou'd be much larger, in Respect of their Gravities, than that of the like Particles of Water, in Respect of their Gravities; and consequently the Mercury wou'd rise in the Alembic with much fewer Degrees of Heat, than the Water upon this Account. But, 2. The Particles of Mercury are perfectly Spherical and Equal; (for all Homogeneous Bodies must consist of Particles *Similes & aequales* in the *Euclidean Sense*, *Vide Def. 1. 6. & 9. 11. Euclid.*) and consequently can only touch in Points, and thereby their Sublimation will

will become more easie. A Sphere can be touch'd but by 12 other equal Spheres, and that too, but in so many Points; and if we suppose the superficial Particles of the Mercury to be first rais'd in the Alembic, they can be touch'd only by 9 other. Now the Force and Value of such a Contact as this of 9 Points, is less (*Cæteris paribus*) than that of other solid Bodies generated by the Circumrotation of whatever Figure, Regular, or Irregular, Right-lin'd, or Curve-lin'd: For, the contacts of Circles is the Measure of the contacts, of all other Figures whatsoever; and tho' in some Curves their Contacts in some Points, may be less than that of Circles (*vide Scholium Lem. II. Princip. Phil. Mathem. Newtoni.*) yet in all their other Points, they will be proportionally greater, and consequently the Value of the whole Contacts greater than that of Circles; wherefore it is evident, that Spherical Bodies will be more easily separated than any other, and consequently will rise in the Alembic with fewer Degrees of Heat than any other. *I suppose,*

2dly. THAT the only Effect of the Sublimations, and other Preparations of Mercury,

Mercury, is the dividing it into these Parts of the first Composition, which are Spherical, *Per suppos.* 1. Or into parts of a more complicated Composition, which (by reason of the vast Gravity of Mercury, in Respect of other Fluids, and the uniform pressure of the *Medium*) may be still Spherical : For if the Mercury be pure, and no Heterogeneous lighter Body be mix'd with it, it will still retain its Sphericity, till the *ratio* of the Surface of a Particle of Mercury to its Gravity, be to the *ratio* of the Surface of a Particle of Air to its Gravity, as is the Specific Gravity of the Air, *i. e.* (putting the Specific Gravity of Mercury to that of Air, as m to n ; and the Diameter of a Particle of Mercury x , and that of a

Particle of Air a) till $m : n :: \frac{x^2}{a^2} : 1$

The x will be equal to $\frac{a}{\sqrt{\frac{m}{n}}}$ that is, (sup-

posing a equal to Unity as the Standard m to n as 10800 to 1 *proxime*, as all know) the Diameter of a Particle of Mercury must be 10800 Times less than that

that of a Particle of Air, or the Particles of Mercury themselves, 12597 12000000 Times less than these of Air, before they lose their Sphericity. Now besides these Divisions into Spherical Particles, the Saline Bodies which are mix'd with the Mercury in these Preparations keep these asunder and disjoyn'd; like so many congeal'd little Bullets separated by the Fixation of some Liquor. This is (as I suppose) the whole effect of these Preparations; as is evident from what Mr. *Boyle* and all other *Chymists* have found; to wit, that from all the Transmutations, and Preparations of Mercury they cou'd elicit the same uniform heavy Fluid; which cou'd never happen if they were any other (besides the now mention'd) effect produc'd by these Preparations: For by what means soever you dissolve this congeal'd Separation, the greater Gravity of Mercury brings its Particles into their former Union, and thereby reduces them into the same Fluid Quick-silver. Besides these two Suppositions, it is to be observ'd,

I. THAT the chief Ingredients in Mercurial Preparations are (besides it self) common and Armoniac Salts, and their
Spirits

Spirits, the Spirit and Oyl of *Nitre*, *Vitriol* and its Spirit, and the like (which afterward we shall call by the General Name of *Saline Bodies*.) All which (we know) are endued with a vast Power to vellicate and stimulate the more sensible Parts of Animal Bodies, and (consequently) to produce Vomitings and Purging (of themselves) according to their Quantity, and the Degrees of their natural Force.

2. THAT the only Effect of repeated Sublimations in these Preparations, is, the Division of the Mercury into smaller Particles, and the freeing of these from the grosser and more noxious Parts of these *Saline Bodies*; for Mercury sublimating more quickly and easily than these other *Saline Bodies*, must in repeated Sublimations, have a greater Proportion to the *Saline* Mixture, than in the first Sublimations, and consequently the subsequent Sublimations must have less of those *Saline Bodies* than the *Antecedent* whereby the Preparation will become sweeter and less vellicating. This is evident from the *aquila alba* & *panacea Mercurialis*, which are all much heavier (especially) than any other Preparations of Mercury.

THESE things premis'd, I come to explain,

II. THE Manner of the Operation of Mercurial Medicines; in performing which, I distinguish two Cases. 1. Either the Medicine is taken inwardly. Or, 2. It is applied outwardly; under which Head I comprehend both Mercurial Inunctions and Plasterings. As to the 1. After the Medicine is taken by the Mouth, it descends into the Stomach, and there the Saline Parts of the Composition vellicate the *Fibres* thereof, which occasion those Gripes are felt upon the taking these Medicines: And if the Saline Particles have a considerable Share in the Composition, they so powerfully stimulate the *Fibres* of the Stomach, as to bring it into these Contractions, which produce Vomiting, as has been formerly explain'd: The Mercury it self, with some of the Remainder of the Saline Particles slipping into the *Intestines*, do likewise vellicate these, and occasion a gentle Purge; which Effect, tho' it be constant (in the first Days after taking these Medicines) yet it is never so violent as that of other Purgatives; because most of its Force is spent
in

in the Stomach. Now that both the Vomiting and Purging produc'd by these Medicines, are owing to the saline Parts of the Composition, is evident from the Nature of Mercury, and the Effect produc'd in it by the Chymical Preparations thereof just now explain'd: For Mercury consisting of Spherical Particles, and by such Preparations being only divided into these, of themselves (as being Spherical) these Particles cou'd never occasion the Stimulations, which (as has been formerly shewn) are necessary to produce these Effects: The only thing they can contribute towards them is, that by their excessive Gravity and Smallness, they are capable to dissolve the Cohesion of the more viscous Fluids of the Stomach and Intestines, and consequently make them flow more easily, when the Muscular Fibres of these Parts are otherwise brought into Contractions. Besides, we see that the forementioned Effects, are mostly produc'd by those Compositions, in which most of these Saline Bodies enter. As in the corrosive Sublimate, the white and yellow Precipitate: But in the others, which pass many Sublimations, (as the sweet Sublimate, and the Panacea Mercurialis) we judge of their Goodness as

they produce least of these Effects. I as-
 cribe the Sweating produc'd by a Dose of
 some of these Compositions, partly to the
 violence of the Vomiting, and partly to
 the Saline Particles which enter the Com-
 position; and that small Salivation, to
 the immediate Action of these *Saline*
Bodies upon the Salivary *Glands*, and not
 to the Mercury it self. All these will
 be evident to any who have seen the sud-
 den Effects of these Medicines, which
 have not had sufficient time, neither to
 enter nor circulate with the Blood, so
 as to be able to produce the Mentioned
 Sweating or Salivation after the ordina-
 ry Manner. Thus I have endeavour'd
 to explain the Effects of these Medicines
 while they are in the *Prima Via*. I shall
 now show the manner of their Operati-
 on in producing a *Flux de Bouche*, that
 thereby the lesser Effects of this Kind
 may be understood.

THE Mercury being freed (by the
 Action of the Stomach, and the Heat of
 the Liquors contain'd in the same and in
 the *Intestines*) of most of the saline Part
 of the Composition, enters the Blood
 by the *Lacteals*, and is with it carried a-
 bout through the Canals where either it,

or any Liquor (of the Body) generated by it, flows; (the small Remainder of these Saline Particles, which adheres to the Mercury after the Action of the Stomach and *Intestines*, assisting the Propagation of the Motion, by the velicating the sides of the Canals) and having the same Celerity, but a much greater weight, it has consequently a greater Force and produces a stronger *Ictus*, and thereby (when once any considerable Quantity thereof has enter'd the Blood) it (by its great Force, and the smallness of its Particles) dissolves the unnatural Cohesions of all the Liquors, renders them more fluid and active, and likewise digs out all the Obstructions of the impassable Canals like so many little Bullets shot against a mud Wall, every little Bullet breaks down a Part till the whole be levelled; and this it is the more able to perform, both because it is exceeding weighty, and makes therefore a greater and more forcible *Ictus*, and because its Particles are exceeding small, and are therefore to be consider'd as so many exceeding sharp Wedges or *Cunei*. Besides, by the smallness of its Particles it is able to enter into these slender Canals in which the Blood cannot freely pass, and

thereby to scour all the Passages be they never so small. And that there are Canals, through which the Globules of the Blood cannot freely pass, we are convinc'd from Microscopical Experiments. Thus all the Liquors of the Body being attenuated, and consequently their Celerity and Force render'd greater, and all the Canals scoured, and rendered passable, the whole *Glands* of the Body are set a work, and throw out the more noxious and less fluid Parts of their Liquors (by Reason the Particles of the Mercury either dissolve, or carry before them all the gross Particles which resist them) and thereby the Perspiration, Urine, Salivation, are increas'd, and the quantity of the Fluids lessen'd, and the whole Body emaciated, till there be nothing left but pure and useful Liquors, and clear and passable Canals. Those who can only be convinc'd by ocular Demonstration may see a kind thereof in *Phil. Trans.* for Jan. 1700. where *Leeuwenhoek* from Microscopical *Experiments* on *Tad-poles*, confirms the main of this Doctrine, as to the Manner of the taking away Obstructions.

BUT there is another Effect of Mercurial Medicines, which is no ways to be

be forgotten ; for besides these mention'd Effects, it destroys that corrosive Faculty of the Liquors, which bursts the superficial Vessels, and produces those constant Pains, Scabs, Ulcers, and the like, which we feel ; For, supposing an Obstruction in any Vessel (either by the Corrosiveness or Viscidity of the Liquor, or from some extrinsick Cause) the Liquor stagnates and coagulates there, and by the Force of the fluent Part of that Liquor, and by the Corrosiveness of the stagnated Part, the Vessels are miserably distended, and their Parts dilacerated, which occasions constant Pain in that Part ; or they burst, and the Liquor putrifying, occasions a Botch, Scab, or Ulcer, more or less Dangerous and Painful, as the Corrosiveness of the stagnated and putrifying Fluid is greater or lesser. Now, this corrosive Faculty must proceed from the pointedness of the Particles (perhaps these Particles may consist of four equilateral Triangled Plains, for such have the greatest equal Degree of Acuteness on all their Points, which seems necessary to make them equable in their Actions, and Homogeneous in their Natures) of the stagnated Fluid. Now, the Mercury will not only remove the

Obstruction, and make the Vessel passable by its Weight, but likewise by the same will break off, and plain the Points and Angles of these Particles; and so render them harmless and innocent; for *Sublata causa*, &c.

BUT here it might be objected, that the grand Effect (as most People believe) of Mercurial Medicines is Salivation, and that really the Salivary *Glands* secrete more of their Fluids proportionally than any other *Glands* of the Body, which is contrary to the 5. *Prop.* about Secretion. To this I Answer,

1. THAT the principal Effect of Mercury, is the attenuating the Fluids, the clearing the Canals, and the destroying the Corrosiveness of the Obstructions, and that Salivation has no more Title to be the principal Effect of Mercury, than insensible Perspiration: For all the *Glands* (notwithstanding the Objection) secrete their respective Liquors in the Proportion mention'd in *Prop.* 5. about Secretion.

2. It is evident that Salivation is not the main Effect of Mercury, from this, That many Persons are cur'd of very dangerous Poxes, Ulcers and Rheumatisms, without

without ever Salivating, at least at the ordinary Rate of Salivation. But 3. The Reason why we seem to secern more by the salivary *Glands* proportionally than by any or most others, are these, 1. The salivary *Glands* are more in Number than any of those which separate visible Fluids; and consequently it is but reasonable they should secern more than any other. It is true, the *Glands* of insensible Perspiration are more in Number than those; and it is not to be doubted, but they secern more likewise; and it will be found so whenever the Thing is examined after *Sanctorius's* Method; but that Secretion not being visible makes the Matter doubted. 2. The Canals which constitute the *Glands* of Salivation are evidently wider than these of others, as is clear from their spongy and soft Contexture; and so it is very accountable from their mentioned *Prop.* why they secern more plentifully. 3. The Fluid secern'd in the Salivary *Glands* is ropy and viscid, and one Part draws forward another, which does not happen in most other *Glands*, and upon this Account it is no Wonder, that those secern more than these. 4. The Salivary *Glands*, in some People, have

have not so good a Contexture, and so obvious a Course, as in others: And this is the Reason, why some salivate little or none, and others too much. But 5. The true Account of the Matter is this, The *Saliva* being a tough ropy Substance, cannot be thrust out so fast, as the Mercury carries it forward, especially seeing it separates only the most glutinous Parts of this *Saliva*; whence all the Salivary *Glands* begin to swell, until there be such a Quantity accumulated, as together with the Force of the Mercury, and of the succeeding Fluid is able to burst the Orifices of the *Glands*: And it is observable, the Salivation continues only so long, as any of the *Glands* are found swell'd. Whence it is evident, that this plentiful Salivation depends upon this, That the Fluid is as it were laid up in Store to be deriv'd more plentifully afterward; whereas in the other *Glands* the Fluid being thinner, is secerned as fast as it is driven forward: And hence it comes to pass, that we think the *Saliva* secerned, is much greater in Quantity than what is derived from the other *Glands*. If we take in all these Considerations together, they will account

count for the plentiful Salivation by Mercury.

2. As to the second Case. In Mercurial Inunctions the viscid Matter, in which the Quick-silver is wrought and pounded serves only to keep the small Particles thereof separated and asunder, and to apply them to the Skin, 'till by frequent rough Frictions the smallest Particles of the Mercury are forced through the Sides of the Cuticular *Arteries* into the Blood; and when once they are got thither, they are in the Estate just now mentioned, and operate after the Manner already explained. And indeed, this were the shortest and easiest Course of raising a *Flux de Bouche*, if Mercury could be adjusted to the Strength and Constitution of the Patient, (for the Quantity of Mercury, which will kill one, will not produce the design'd Effect of Salivation in another) by this Method, as exactly as by Administring it gradually in Doses, by the Mouth. But it cannot be done so, and therefore the latter Course is the more safe.

MERCURIAL Plaisters apply'd outwardly, to heal Scabs, or inveterate Ulcers, operate thus; The corrosive saline Mixture, if there be any Part thereof in the Composition, eats away and corrodes the putrid Matter, which sears up the Mouths of the Vessels; so that the Mercurial Particles get easily into them, where they both clear the Vessel of the Obstructions, and destroy the Pointedness of the Particles of the Fluid, which two Things did concur to make the Ulcer sore. If there be no Saline Body in the Application, then the Mercury must be forced in by Friction, into the Mass of the Blood, to produce the designed Effect.

THUS from a few easy and evident *Postulates*, I have given an intelligible Account of the Manner of the Operation, and of the Effects of Mercurial Medicines, when the Mercury enters in any Quantity into the Mass of the Blood, and from thence it will be easily understood, that when the Quantity is less, the Effects will be proportionally lesser; so that it will be needless to explain all the several Degrees thereof by Detail,

tail. But seeing it is evident from *Leenwenhoek's* Observations in the last mentioned *Phil. Trans.* That the Force of the Blood is able to wash away some Obstructions; let us take a gross Estimate of the Proportion of the Efficacy of the Blood assisted by Mercury, to the Efficacy of the Blood itself, and unassisted to take away Obstructions. First, then, we must consider, if instead of the ordinary Liquors there pass'd nothing but Mercury in the Canals of the Body; the Weight of Blood being to that of Mercury, as 1032 to 14593, or as 1 to 13 at least, and their Velocities being the same, Mercury would at least be 13 times more able to remove the Obstruction, than the Blood of itself: But it is certain (if the Obstruction renders the Canal impassable) there can be no Particle of the Mercury get away; and (when there is any Quantity thereof got into the Blood) there are still some new Particles thereof coming up, so that after some Time (they having a greater *Momentum* than the *Globules* of the Blood, and thereby getting through it up to the Obstruction) we may consider, there will be little or nothing save Mercurial Particles at, or near the Obstruction,
driven

driven against it, by the whole Force of the Blood; so that, as the Obstruction itself, it is very near the same, as if the whole Canals run Mercury. However, let us take the Proportion only as 1 to 10; so that upon this Account the Blood assisted by any considerable Quantity of Mercury, will be 10 times more able to remove the Obstruction than the Blood unassisted.

Secondly, Let us consider, the *Globules* of the Blood are Elastick (for they often lose their Figure in strait Canals, and recover it again, as *Leeuwenhoek* has shown, which is the Definition of Elasticity) and those of Mercury are not, or very little so: And consequently upon this Account, the Efficacy of the *Globules* of Blood will be hugely diminished. Let us suppose, it loses $\frac{1}{2}$ of its Efficacy (which is a liberal Allowance) and then the Proportion will be $\frac{3}{4}$ to 13, or 3 to 40.

Thirdly

Thirdly, Let us observe, That the *Globules* of the Blood, and Mercury driven against the Obstruction, and at every Pulse digging away a Part of the same, may be considered as *Cunei*. Now *ceteris paribus*, the Force or Efficacy of *Cunei* is reciprocally proportional to the Angles, their Edges make. But in Spheres the lesser or greater Degree of Curvity, is to be considered as these Angles, when these Spheres are consider'd as *Cunei*: And Degrees of Curvity in Spheres (as in Circles) are reciprocally as their *Radii*. Supposing then the Diameter or *Radius* of a Particle of Mercury is to that of a *Globule* of Blood, as 1 to 100 (and there can be Reasons given, some of which I have formerly hinted, why the Odds may be supposed much greater) then the Force of the Mercury, and the Blood, to that of the Blood unassisted, to remove Obstructions, will be as 4000 to 3. Lastly, let us consider, that by the Force of the Mercury, the Liquors of the Body are exceedingly attenuated, and rendered more moveable, and are thereby capacitated to receive a stronger Impression; so that they both move more quickly, and with greater Force, as is evident

evident from the Pulse of those, who are under a *Flux de Bouche*, whose Pulse is little less frequent and strong, than the Pulse of those in a Fever. Let us suppose the Proportion, both of the Frequency of the Pulse, and of its Strength, to that of an ordinary one, as 3 to 2, (and this is certainly much less than the Truth) then it will be as 3 to 2, upon the Account of its greater Force; and again as 3 to 2, upon the Account of its greater Frequency, that is as 9 to 4. So that now upon this last, and all the former Accounts, the Proportion of the Efficacy of the Blood, assisted by any considerable Quantity of Mercury, to that of the Blood unassisted, to remove an Obstruction, will be as 36000 to 12, or as 3000 to 1. So that the first will be 3000 times more effectual for that End, than the latter. But if any should still think, we have made too liberal Allowances for the Mercury, let us rebate the Proportion one third Part; yet still the Blood, assisted by any considerable Quantity of Mercury, will be able to do as much toward the Removal of an Obstruction in one Day, as the Blood unassisted in three Years almost.

BESIDES

BESIDES, there are a great many Cases in which the Blood unassisted, is so far from being able to remove the Obstruction, that it will continually encrease the same: For if the Obstruction proceed from a Depravation of the Liquors of the Body, as in *Rheumatisms*, or if some corroding Matter, be forc'd into the Liquors, so as to be able to vitiate the same, as in Poxes, Pests, and Poisons, it is demonstrable, that (without some external Assistance, either by Diet or Medicines) the Malady, instead of mending by Length of Time, will increase. But if the Obstruction proceed from some external Injury, as in Bruises, Wounds, Colds, and (perhaps all continual) Fevers, the Liquors (still persisting in their natural and wholesome Estate,) may do much to drive away the same by Length of Time; but still the sooner, and more safely if they be assisted by convenient Medicines. I come to,

III. THE Advantage and Usefulness of Mercurial Medicines.

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AND, 1. They are useful for destroying the Viscidity and Thickness, the Corrosiveness and Pointedness, of the Particles of the whole Liquors of the Body, rendring them Fluid and moveable, innocent and harmless, if before they were otherwise.

2. THEY are evidently useful for removing all Obstructions, Ulcers, Scabs, Botches, Swellings, constant Pains, (all which are but the Effects of some kind of Obstruction or other) of whatever Nature or Kind, by adjusting only their Quantities rightly, but that is the Work of an able Physician.

NOW, for answer to the Question, which gave Occasion to this Discourse: Mercurial Medicines were exceedingly useful, and wou'd answer the whole Design in curing Fevers, were it not upon these two Accounts. 1. Before they cou'd be effectual for this Purpose, they ought to be Administred in a large Quantity, which never misses (by the Violence and Force of the Motion of the Blood thereby occasion'd) to induce a new Fever in a Patient, of it self, so
that

that instead of curing the former Fever it wou'd double it, and make the Danger double, which by no means is to be done ; the Patient having enough a-do to wrestle with one. But, 2. It requires so long time to bring the Effects of Mercurial remedies to any Height, that the Patient (in so long a space) wou'd be cur'd by the Force of Nature, or kill'd by the Violence of the Disease, so that upon this Account they are rendered useless. Besides there are a Thousand other Inconveniencies which render this Method in its full Force, altogether impracticable.

AFTER all, I remember to have been told (some time ago) by that Eminent Physician of our Countrey, (whom I have thrice already mention'd) that People who have been severely flux'd, seldom fall into dangerous Fevers, and that in Fevers of Children occasion'd by Worms, Mercury, if discreetly us'd, is always, and in some Fevers of riper Years, is often, very successful. The Reason of both, which is very evident from our Doctrine.

FOR, in those who have been severely flux'd, the Blood is so purify'd, and render'd so fluid, and all the Canals are so cleans'd and scour'd, that if at any time there shou'd happen such Obstructions as occasion Fevers, Nature is able in a short time to drive them away, seeing they must rather happen from some external Cause, than from within, where all is clear and passable.

As for Fevers occasion'd by Worms among the Fluids in the Bodies of young Persons, (which by the way is an Argument omitted for our Theory of continual Fevers, as is likewise the *Febris Variolarum*, both which are occasion'd by Obstructions, as is evident from the Botches which break out upon the latter, and as shall be just now shown of the former:) For here a little Worm being forc'd into some of the capillary *Arteries*, where it can neither get back nor forward, totally occludes the Passage of the Blood, and thereby occasions a Fever after the Manner already explain'd. Now the Reason, why the natural Force of the Blood is not able to remove such an Obstruction is, because a living Creature

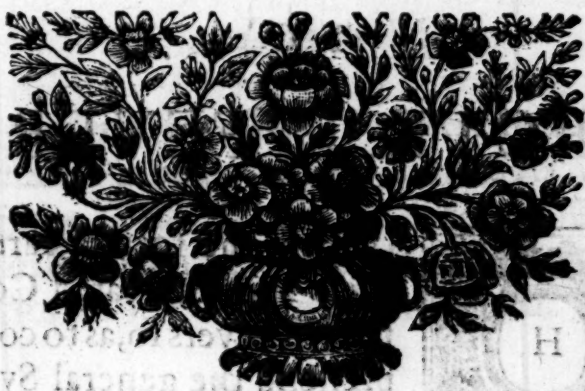
Continual Fevers. 133

ture makes it, which will not be mouldred away after the Manner of coagulated Blood; but will require the greater Weight, and force the Mercury to kill it first, and then both the Mercury and Blood concurring, wash it away.

APPLICATION

TO THE

General Proposition



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the common Appearance of each may be
 ascribed for, from an Obstruction of the
 Canals which constitute the Glands, and
 thereby an Augmentation of Quantity of
 the Blood in the passable ones; and how all
 the Changes of the Motion and the Quan-
 tities

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THE
APPLICATION
TO THE
General Proposition
TO
HECTICK FEVERS.



Having in the former part of these Papers, treated Continued Fevers so, as to comprehend the general Symptoms which are common to each kind; shewing how the common Appearances of each may be accounted for, from an Obstruction of the Canals which constitute the *Glands*, and thereby an Augmentation of Quantity of the Blood in the passable ones; and how all the Changes of the Motion and the Qualities

lities of the Blood necessary towards a true Theory of Hot Fevers, did naturally follow from thence; so that the general Doctrine may easily be applied to all the Varieties of continued acute Fevers. I shall now endeavour to shew, how the Appearances of slow consumptive Fevers in general, and of *Hectick Fevers* in particular, may be deduc'd from the other part of the general Proposition; viz. from a Dilation of the Constituent Vessels of the *Glands*: In order to which, I premise the following

Lemma III.

Ceteris Paribus, The Strength of different Animals of the same Species, or of the same Animal at different Times, are in a triplicate Proportion of the Quantities of the Mass of their Blood.

Demonstration.

It is evident from the Animal Oeconomy, that the Augmentation or Encrease not only of all the Fluids, but likewise of all the solid Parts of the Body is owing to the Blood, and that the same (all other things being equal) is proportional to

the Quantity thereof; and it is certain, from infallible Experiments, that (whatever be Cause of Muscular Motion) the Blood it self, the *Liquidum Nervorum*, and the Muscles *i. e.* a bundle of Muscular Fibres, and the Integrity of the same) are only and absolutely necessary to the Action of the said Muscles; for, put any two of these, and entirely take away the third, no Motion will follow: Wherefore the Forces of any one, or of all the Voluntary Muscles, *i. e.* the strengths of Animals are in a compound Proportion of all these Three. But the Quantity of each of these three, in this case depends upon, and is in Proportion to the Quantity of the Mass of the Blood, as has been just now shewn: And therefore the Strengths of different Animals of the same Species, or &c. *q. e. d.*

Scholium.

It is not so easie to compare the strengths of different Animals of the same Species, as to compare the Strengths of the said Animals at different Times; for in the first case, before the foresaid *Lemma* can obtain, it is necessary they be of the same Age, Stature, Disposition and

and Constitution, all which Conditions are hardly found or made evident to be so: But in the latter it is necessary only, that the Animal gently and insensibly encrease or decay, as in the same Animal, Young and Old, and betwixt the two. But whether in the same, or different Animals, if these Conditions were equal, it were easy to determine the Proportion of their Strengths; for then, opening the same Vein or Artery in both, making (as near as may be) the same Orifice and Ligature in the same Place of the Vein or Artery; observe the Quantities of Blood emitted at the same Time. The whole of the Masses of their Blood shall be as the Quantities emitted, and consequently their Strengths in a Triplicate Proportion of these.

Corollary.

HENCE the Reason is evident of the Disproportion of the Strengths of the same Person, a Boy, an old Man, in the mean betwixt the two, and in a Fever; altho' the Odds betwixt the Quantities of his Blood, at these different Seasons, be not so great; for, let the Quantities
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of his Blood, in the same Order I have named them, be 10, 15, 20, 30 Pounds, *i. e.* their Proportions, 2, 3, 4, 6, his Strength shall be in these Proportions, 8, 27, 64, 216; how this Proportion somewhat abated, serves to account for the Weakness of Hectick People, shall be afterward shewn.

Proposition.

THE general and most effectual Cause of Hectick Fevers, is a Dilatation of the constituent Vessels of *Glands*, (or to express it more universally, as it may be done in the other particular Proposition) of the Conduits of Secretion.

SUPPOSING a Dilatation of the Conduits of Secretion, it will follow as a Corollary, that the Quantity of all the Fluids of the Body may be suppos'd thereby diminish'd in any given Proportion of Minority to the whole of these: For, from the said Dilatation suppos'd, there will follow a greater Velocity of the Fluids contain'd in the Canals of the Body, as shall be afterward demonstrated: And since, by the 5th Proposition

about

about Secretion, the Quantity separated is in a compounded Proportion of the Velocity of the Fluid, and of the Orifice; both these being augmented, the Quantity of the Separation must be proportionally augmented, and consequently, the Quantity of the remaining Fluids proportionally diminished; so that merely upon this Account, when a Person falls into a *Hectick* Fever, we may suppose the Quantity of his Blood (because it is from the rest of the Fluids, which we are speaking of, generated) to be considerably abated: Let us suppose him from 20 Pounds in his ordinary State, to have dwindled into 16; then, by *Lemma Primum*, and its *Scholium*,

$a - 4 = 12$ Pounds, in case of a Subduple
 $a + 6$
 Dilatation; and $\frac{a}{2} = 12 \frac{1}{2}$ Pounds, in
 $a + 6$

case of a Subtriple one, *i. e.* if there be (upon the foresaid Account) suppos'd but 16 Pounds of Blood in a *Hectick* Person, as the *Media Quantitas*, and that to the Cylindrical Canals (equal to the whole Vessels of the Body, save the Intestines and

and Laſteals) there be added another, whose Orifice is equal to one half of the former (*i. e.* if the Veſſels be dilated in their Orifices one half) then the Quantity of 16 Pounds of Blood in theſe ſo dilated Veſſels, ſhall be but like 12 Pounds in theſe Veſſels, if they had not been dilated, and produce but ſuch Effects, as ſuch a Quantity would do in the Canals) if they were in their ordinary State; and ſo in other Dilatations. From both theſe Conſiderations its clear, we may ſuppoſe the Quantity in all Fluids of Heſtick People abated at any required Rate of Minority.

COME we now to ſolve the Appearances of Heſtick Fevers. From the Dilatation of the Conduits of Secretion, and the Diminution of the Quantity of all the Fluids, and of the Blood eſpecially, it follows.

§. I. THAT the Velocity of the Blood will be greater, and conſequently the Pulse more frequent and quicker. The taking away an *Impedimentum* from one Side, is equivalent to (the Circumſtances continuing the ſame as formerly) the adding an equal *Momentum* on the other: Wherefore,

Wherefore, if I shew, that the *Impedimenta* to the Motion of the Blood, are (by these) taken away, it must follow, that the Motion and Velocity thereof must be augmented. This I shall do in these three Particulars, 1. It is certain, that one great Resistance to the Motion of the Blood, at the Heart, or in the Arteries, is the precedent Blood in the Arteries, continued through the Veins to the Heart and Arteries again; for the preceding Blood always hinders the succeeding, seeing before the one succeed in its Place, the other must be remov'd: And this Resistance is always proportional to the Quantity of the Mass of the whole Blood; but the Quantity of the Blood being diminish'd, this *Impedimentum* must be proportionally diminish'd, and consequently the Velocity of the rest, greater. This we evidently perceive in the Time of Blood-letting. 2. Another principal Resistance of the Motion of the Blood, is the striking of the Particles of the same against the Sides of these Vessels, especially Conical ones; now the Dilatation of these Vessels will much lessen this Resistance, upon these three Accounts. 1. The Vessels being dilated, the Cylinder, whose Base is the per-

perpendicular Section through the Axe of the narrowest Passage of the Canal, will thereby be augmented, and consequently many more Particles than otherwise, get free, without striking against the Sides of Canals. 2. Those who do not strike, are remov'd to a greater Distance from the Sides of the Canal; *i. e.* their Motion is quicker; for, in this Case, the Sides of the Vessel are as *Fulcra*, and the greater Distances as longer *Vectes*, and consequently the Celerity as these *Vectes*. 3. The Surfaces of little Things have a greater Proportion to their Bulks or Solidities, than those of greater Things to theirs; and therefore internal Surface of a smaller Vessel, will be greater in respect of its contained Fluid, than those of a greater Vessel in respect of its, and consequently against the internal Surface of this dilated Canal, fewer Particles of the Blood will strike, than against the same when it was narrower.

III. A third Resistance to the Blood, is the Pressure of the circumambient Muscles, Bones, Tendons, and distended Canals, which do surround the Arteries (many of them) on every Side, and drive the Sides thereof inward: Now this is entirely taken away, by the Emaciation

Continual Fevers. 143

ciation and Consumption of these solid Parts, which always precede Hectick Fevers. And, IV. Besides all these, the Velocity of the Blood must be encreas'd; because (as shall be just now shewn) it is dryer, hotter and more saltish than ordinary, and consequently it will (by the stimulating Quality following upon these) bring the Heart into more frequent Contractions, and encrease the Propagation of the Blood in the Arteries. Now from all these, it being evident, that the Velocity of the Blood is greater, it follows: I. That the Pulse must be more frequent; for the Heart being an involuntary Muscle, its constant Motion must, and does depend upon the Influx of the *Liquidum Nervorum*, forc'd into it by the Arteries running upon the Nerves in the Brain; every beating of the Artery, forcing the *Liquidum* into the Muscle of the Heart, whereby it contracts, and the Velocity of the Blood being greater, this Influx must be more frequent; *i. e.* The Heart must contract oftner, and the Arteries likewise; for the Contraction of the Heart, and the Frequency of the Pulse, is always proportional to the Velocity of the Blood. II. It must be quicker, because by the
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great Velocity of the Blood, it stays but a short Time in the Expulsions of the Artery outward; *i. e.* it does not continue any long Time forcing the Artery against the apply'd Fingers.

§. 2. THO' the Pulse be frequent and quick, yet it must be weak; this is evident upon these two Accounts. I. The Quantity of the Blood being small, the Arteries not being distended therewith, cannot be driven so far outwardly as ordinarily; and the *Ictus* of all unbending spring Bodies, *Ceteris Paribus*, being proportional to the Degrees of their being bended, the Arteries by this Defect of Blood being less bended or contracted than ordinary, must strike more weakly against the apply'd Fingers. II. The Arteries not being so much bended as ordinarily, must likewise strike forcibly upon the Nerves running by them, and therefore a less Quantity of the *Liquidum Nervorum* will be forced into the Heart, and consequently the Heart contract less forcibly; *i. e.* the Pulses must be left weaker.

§. 3. THE Blood must be dryer, more gross, and more saltish than ordinary;

nary; for the Canals being wider *ex Hypothesi* and the Velocity of the Blood greater *per* § 1. The Evacuations must be proportionally greater *per Prop. 5 de Secretione*, and seeing *per ejusdem* 3. the Parts of least Cohesion and greatest Fluidity, *i. e.* The thinnest, most humid and aqueous Parts are first secern'd; and most easily; therefore the dryer and grosser Parts will be last secern'd; *i. e.* the remaining quantity of the Blood will be dryer or less humid, grosser or less thin, and consequently less saltish.

§. 4. THERE must be felt somewhat a greater Heat than ordinary, especially about the Arteries and Hypochondres. There must be a greater Heat than ordinary, felt over the whole Body for these Reasons. 1. The Blood has greater room in the Canals (they being suppos'd dilated) and consequently the Heat will have more Liberty, and not be so much pent up as ordinarily; and therefore it must break out more plentifully from the Particles of the Blood communicated by the greater Velocity thereof. 2. Supposing no greater Heat than ordinary in the Body, yet it will be felt greater because (the Conduits of Secretion being

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dilated) the Heat which is in the Body has a freer Egress outward, and must stream out more abundantly upon any Thing which touches the Skin of the He-ctick Person. 3. The Blood is more dry and saltish than ordinary, *per* §. 3. And therefore, upon this Account, there will be felt a greater Heat. This Heat is greater about the Arteries, because the Celerity of the Blood there being greatest, must there most plentifully disintangle the Heat from the Particles of the Blood wherein it is lodged, and greatest in the right *Hypochondre*, because there most of the Liver is situated (which is the Laboratory of the Bile) which secerning commonly a hot saline Fluid must be much more so now; likewise betwixt both *Hypochonders*, are the *Spleen* and *Pancreas* placed, in which, on this Occasion, a more than ordinary Heat may many Ways happen. This Heat, whether universal, or particular, is scarcely ever felt by the Patient, both because it is a great deal more moderate than that of acute continued Fevers, and because a long Habit and Custom has made it insensible, as they do in all other Things.

§. 5. THE Reason of the Encrease of the Frequency of the Pulse, and of the Heat after eating is easy from these Reasons. 1. Because there is a greater Plenty of the *Liquidum Nervorum* generated, which will make the Heart contract more frequently; *i. e.* will make the Pulses quicker: And, 2. Because the Chyle entring into the Mass of the Blood, will be immediately (because of the Velocity of the Blood) divided into minute Parts, and the Heat thereby disengaged; *i. e.* the Body will be hotter *per* §. 4. And both these Effects will continue as long as any of the Effects of the Repast remains.

§. 6. THE vast Decrease of Strength is evident from *Lemma* 3. It is true indeed, the Encrease of the Velocity of the Blood, demonstrated §. 1. will somewhat abate the Proportion there given; but we must consider, tho' the Celerity of it be considerably great, yet the Quantity thrown into any determined Part of the Body at one Contraction of the Heart (which is all that is here useful) is very small: Besides, there is a great Difference betwixt the Motion of the volun-

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tary Muscles (which is the proper Estimate of Strength) and that of the Involuntary ones, such as the Heart; for the Pulse may be very quick, from such Reasons as I have shewn, §. 1. and yet the Patient very weak; so that from these it is clear, that there is no great Occasion for abating any Thing of the afore-said Proposition; however, giving as much as may be required, still there is sufficient in this *Lemma* to satisfy this Appearance.

§. 7. FROM this Decrease of Strength, *i. e.* Weakness, it is clear, why Persons labouring under a Hectick Fever, are unwieldy, unactive, and as it were sluggish.

§. 8. THE Urine of Hectick People has the ordinary Colour, but it is greater in Quantity in Proportion to their Drinking, *per 3 and 4 Prop. De Secret.*

§. 9. LASTLY, It is evident from what has been said, that if these Symptoms be not removed, they will necessarily encrease, even into those Heights, which they call the Second and Third Degrees of these Fevers, till they end in an intire

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Extenuation and inevitable Death. This needs no Proof.

I. THUS, from the Supposition of a Dilatation of the Conduits of Secretion I have accounted for all the Appearances of this Kind of Fevers, which is one Argument for the Verity of our Doctrine.

II. FROM the same suppos'd Dilatation, I have shewn how the Blood will necessarily become hotter and drier, which are all the *Data Bellini* requires to account for these Fevers, which is another Argument.

III. THE Antecedents of Hectick Fevers, such as are Violent Evacuations by Urine, Stool or Sweat, &c. *Ulcers* in the *Throat, Lungs, Kidneys, Womb, &c.* A hot and dry Disposition, precedent long-continued acute Fevers, Drunkenness, Madness, &c. In short, every thing that consumes the Humidity of the Fluid or Solid Parts; I say, all these produce a Dilatation of the Vessels these two Ways.

1. They spend and consume the Solid Parts, by withdrawing their Humidity, so that these shrink in and contract, and consequently do not press so much upon the

surrounded Canals, and thereby they have Freedom to be dilated, as far as the Force of the contain'd Fluids can distract them, or as they naturally of themselves will unbend; for the Canals are forcibly contracted (by the Muscle of the Heart and their own Muscular Fibres) but naturally, and of themselves, they widen and unbend. Now, tho' the violent Evacuation be but in one particular Place of the Body, yet by the *Equilibrium* which is kept in the internal Fluids of the Body, as well as the external Ones, all the others will suffer by it; for all, or most of the Fluids of the Body will be drawn toward that Place, till the consuming Part be brought into an equal Condition (as to Augmentations or Nourishment, over and above what is violently expended) with the rest, and therefore all the parts will consume equally. 2. The Solid surrounding Parts thus giving way, the Canals will naturally unbend themselves, and will be assisted thereto, by the force of the Fluids therein contain'd: And generally we observe Night Sweatings immediately to precede such Fevers, which effectually opens most of the Conduits. Thus both these Ways the Conduits of Secretion are dilated, by the Antecedents of
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Hectick Fevers, which is not an Argument for, but a Demonstration of the Verity of our Theory.

4. A FOURTH Argument, is from the general Principle and Foundation of the Cure of such Fevers, (for taking first away the Occasion of the Distemper if they be Symptomatical, that nothing may remain but the Simple Hectick) they are always cured by such things (which being easily digested, and suited to the Weakness of the Stomach of the Patient, made so by this Malady) as do most augment the solid Parts, and consequently streighten and contract the Canals again.

5. LASTLY, The Appearances upon the Opening of such Persons as are cut off by Hecticks, do evidently confirm our Doctrine; for besides other things (as Ulcers, Gangrenes, and the like) we still observe large lank Canals, big Vessels, slender Muscles, and little Blood.

MUCH more might be added on the Head, but these are sufficient, else twice so much will not suffice.



*A General Method for Examining the
Quantity of the Augmentation, or
Diminution of the Mass of Blood,
arising from an Obstruction or Dila-
tation of the Conduits of Secretion.*



FOR avoiding Confusion in the following Calculation and Discourse, I shall only name the Effects of an Obstruction, because any one, who pleases, may easily with the Help of the immediately preceding Part of these Papers, apply the same Method of Reasoning, *mutatis mutandis*, to a Dilatation of these Conduits, the first being contrary almost in every Thing (here especially mention'd) to the latter.

THAT all continu'd acute Fevers are produc'd by the Obstruction of the Conduits of Secretion, is so very evident, that none who observes, that any long continued Retention of these Things, which

which are usually, and in an healthful State, ejected out of the Body, (which is infallibly occasion'd by an Obstruction of these Passages through which they ought to come) never misses to produce a Fever, more or less violent, can be ignorant of the same. Now the primary and immediate Effect of such Obstructions, is the Augmentation of the Mass of the Blood ; because every thing ejected out of the Body (the Fæces only excepted) is derived from the Blood, therefore the Quantity of the Blood will be augmented, by so much as is the Quantity of that, which ought to be ejected. These Obstructions augment the quantity of the Mass of the Blood, these two ways.

1. By keeping within the Body those Parts of the Blood, which naturally are ejected : Suppose the Passages of Perspiration and Urine were obstructed for one Day, in which a Man should take his ordinary Refection, certainly, the Mass of the Blood wou'd be augmented, by so much as is the Sum of the Quantities, commonly evacuated by Perspiration and Urine one Day, and that too by such a Quantity of Things, of such an ill Quality, as Nature does not think them fit to be lodg'd in the Body of an
healthful

healthful Person. If one shou'd take his ordinary Quantity of Meat and Drink for some Days, and these Obstructions continue, the Mass of the Blood wou'd be increas'd by such a Quantity of vitious Matter, as is the Sum of both these daily Evacuations, multiply'd into the Number of Days, the Obstruction continues. But let us suppose, that the first Days retention of this vicious Matter, does somewhat indispose the Patient, so that he will not be able to eat or drink so much the next Day; let this next Days Repast have any given Proportion to, or be different from the former Days Repast, by any given Quantity, and let these Obstructions, and this *Ratio*, or Difference, continue for any Number of Days, the Mass of Blood will be augmented by a vast Quantity of vicious Matter: How to find the Sum thereof, I shall presently shew. It is true indeed, Nature (by the *Equilibrium* generally kept in the Fluids of the Body) has wisely provided that the Diminution or Suppression of one Evacuation, shou'd be the Augmentation of another, else we cou'd not continue well one Day to an end: But it is likewise true, that this is not always so, at least not intirely:

which

which is sufficient to our Purpose, and therefore, when ever this Case happens, it must infallibly augment the Mass of the Blood. But 2. Not only is the Blood by this Retention augmented, but a great many of the ordinary Passages being obstructed, occasions the Blood only to flow in the passable ones; whereby it is so accumulated there, as to augment the quantity thereof, in the passable ones to a huge Degree. But having already in the first *Lemma*, and its *Scholium*, sufficiently consider'd the Augmentation arising from this Consideration, I shall now shew how to calculate the Increase arising from the former.

I. LET r to s represent the *Ratio* of an ordinary Man's Eating and Drinking in one Day, to his Evacuations more or fewer in the same; let a represent the ordinary Quantity a Man eats and drinks in one Day, x the difference of his Eating and Drinking one Day from another, upon the occasion of an Indisposition arising from any Obstruction, or Retention of the usual Evacuations; and let this difference be constant for some Days, y the Number of Days in which he takes any Refection at all; then the quantity

ty of vicious Matter, by which the Mass of the Blood is augmented, shall be

$$= \frac{2 a s y + s x y - s x y^2}{2 r}$$

2. IF from the Difference of his daily Eating and Drinking given, you wou'd desire the Number of Days in which this Retention shou'd amount to any given Quantity; suppose c , then you may have it from the Solution of this *Æ*quation

$$y = \frac{x + 2 a}{x} y \frac{2 c r}{s x}$$

Wherein x is given from y , and y from x .

3. SUPPOSING the same Quantities continue as they are, only with this Difference, that a Man eat nor drink less every Day at a certain Rate, and not in a given Difference, *i. e.* the Decrease of his Refection being formerly in an Arithmetick Progression, let it be now in a Geometrick one, let the *Ratio* of this last

Progression be m to n , or $\frac{m}{n} = x$; Then
the

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the Quantity of vitious Matter, by which the Blood is augmented in this Case, is

$$= \frac{a^2 s x^{y+1} - a^2 s x^y}{a r x^{y+1} - a r x^y}; \text{ Where } y \text{ or}$$

$y + 1$ is the exponent of x .

4. IF you desire this Quantity to be equal to c , as in the former Case, then the Solution of this Æquation

$$X^y = \frac{a d r}{a d r + a^2 s} X^{y-1} \frac{a z s}{a d r + a^2 s}$$

will give x or y from either of them suppos'd known: If you desire x from y given, you must solve an Æquation denominated by y ; if from x given, you want y , you shall have it by a Table of Logarithms; for, put l to signifie the Logarithm of any Quantity,

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$$Y = l. x) l. \frac{a d s x}{a^2 s x - a d r x} \quad \text{That is}$$

the one Logarithm divided by the other

5. IF you wou'd have the full Effects of these Augmentations, you must add these found out in the first and third Steps to the natural mean Quantity of the Blood, *viz.* 20 Pounds, and then apply the *Æ*quation found out in the first *Lemma*; calling the Sum of both these Quantities *a*. Thus let the 20 Pounds of Blood ordinarily found in a Man, together with the Augmentations (found in the first and third Steps) by Reason of the Retention of the ordinary Evacuations be called *a*, then *per Lemma* 1. The true value of the whole Mass of the Blood, in respect of the passable Canals, shall be

$$\frac{a^2}{a - 6}$$

6. If

6. IF you desire this Quantity shou'd be equal to a given one c , then

$$6 = \frac{a a}{c} - \frac{a c}{c} \text{ and } a - b = \frac{a^2}{c}$$

which are all the possible Varieties of these Cases. The same, with the greatest Ease imaginable, may be apply'd to a Dilatation.





The Application to the general Calculations of some particular Cases.



WE all know, that in a continued hot Fever, the Perspiration is almost or altogether suppress'd not only some time before, but very often, during the whole time of its Period. And *Sanctorius* in the 6th Aphorism of his 1st Sect. says, That if the Meat or Drink taken in one Day, amount to 8 Pound, the insensible Perspiration, will be 5 Pounds: Hence the Proportion of the daily Repast to the Perspiration, is as 8 to 5, and the Quantity taken by the Mouth is 8 Pounds. Let us suppose he takes 6 Pounds of Meat and Drink the next Day, the third 4 Pounds, and the fourth 2, and on the Fifth he falls sick of a Fever, then by the first Step of the general Calculation, the Mass of the Blood will be augmented by $12\frac{1}{2}$, Pounds of vitious Matter; and if in the Second Step of the same, we put $c=12\frac{1}{2}$, then is $y=4$, $x=2$. But if we suppose the daily Repast to decrease in a

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Geometrical Proportion, as 2 to 1, continuing the rest of the *Data* the same as formerly, by the third Step of the same, the Blood will be augmented by 10 Pounds; and if in the fourth Step we put $c=10$, then will be $x=2$, $y=4$. Likewise, if we join these last 10 Pounds of Augmentation, to the ordinary Quantity of Blood found in a Man, then they will make up 30 Pounds; and if we suppose a Subduple Dilatation of the Vessels, then the true Value of the Quantity of the Blood, in respect of the passable Canals, shall be 45 Pounds; if a Subtriple, 40 Pounds; if but a Subdecuple, then the Mass of the Blood will be at least 33 Pounds, by the 5th Step of the general Calculation: And if, in the last Step, we put $c=4$, then shall be $6=7\frac{1}{2}$, $q-6=22\frac{1}{2}$.

FROM all these Calculations, it is evident, that if the Augmentation of the Quantity of the Mass of the Blood, to any assignable Quantity, can produce a Fever, here it may be had; for if a Man naturally eats and drinks but little, or if but a small Part of the Perspiration be obstructed, yet still the Augmentation of the Blood may amount to the assignable

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Quantity

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Quantity if we put but lesser Quantities for x , and greater for y , *i. e.* The Difference of his daily Repasts shall be less, or the Time, e'er he falls sick, longer.

2. IF the Urine be suppressed, either by a Stone, Ulcer, or Carbuncle in the Kidneys, Ureter, Neck of the Bladder, or *Urethra*; or by any other Cause in any other Place about the Organs of Secretion of Urine, and that for any considerable Time, the Person will infallibly be seized by a Fever more or less violent; and tho' this Fever may be partly ascrib'd to the violent Pain which follows upon such Obstructions, from such Causes, yet it is not to be doubted, but it is mostly occasioned by the Augmentation of the Mass of the Blood, by such a Quantity of vitious Matter, as necessarily must be accumulated by such a Suppression: And that we may understand how great this Quantity may be, let us consider, that *Sauætorius*, in his 50th Aphor. of the 1st Sect. says, That the Perspiration is to the Quantity voided by Urine in a giv'n time, as 40 to 16. Wherefore from this, and the former cited Aphorism, *viz.* 6th. it follows, that the daily Repast, or the Quantity voided by the Mouth, is to the

the Quantity voided by the Urethra, as 8 to 2. Suppose then a Man, who has a Suppression of Urine for 8 Days, takes in by the Mouth every Day a Pound less, beginning at 8; then by the first Step of the general Calculation, the Blood shall be augmented by 9 Pounds of vitious Matter. It is easy to apply the rest of the Steps of the general Calculation from these *Data* to this Case, and therefore I shall not trouble my Reader with them: Only it may be ask'd, since the Suppression of the Urine encreases the Quantity of the Blood, and thereby causes a Fever, Why, when a Man drinks a vast Quantity of strong Liquor, he is not thereby thrown into one immediately? To this I answer. 1. That many of the Symptoms common to hot Fevers, are very frequently observed in Persons who are drunk, which is a great Confirmation of our Doctrine; and that real Fevers do very often succeed violent Fits of Drunkenness, especially if the Person get much Cold after them, whereby the Glands, contiguous to the Air, are obstructed. But 2. The Reason why excessive Drinking does not always and immediately throw a Person into a Fever, is, that in the Time, or after the Drink-

ing, there is a vast Secretion by Urine. And how great a Quantity this may be, we shall examine thus: From what was before cited from *Sanctorius*, it is evident, a Man in a Day, or 24 Hours, voids by Urine 2 Pounds or 32 Ounces, *i. e.* there are two Pounds of Urine, discernible from 20 Pounds of Blood in a Day, or (taking one Hour with another) the mean Quantity Secernible from 20 Pounds of Blood, is about $1\frac{1}{2}$ Ounce in an Hour: Now suppose a Man has drank six Pounds of a moderately strong Liquor, all these 6 Pounds, except a very small Quantity are Secernible Serum; wherefore as 2 Pounds of Secernible Serum to $1\frac{1}{2}$ Ounce commonly Secern'd in an Hour, so is 8 Pounds to $5\frac{1}{2}$ Ounces, which upon this Consideration will be Secern'd in one Hour, but we generally observe the Pulses of drunken People to go faster, and with greater Force, than when sober, and that at a very extraordinary rate, insomuch, that we may, modestly speaking, say, they go twice as fast, and with twice as great Force; wherefore, upon this Consideration, the former Quantity must be multiplied by 4. that is, he will pass by Urine about 20 Ounces

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at least in an Hour, and though he doth not secern so much every Hour, yet from this Calculation in the general, we may see that in 7 or 8 Hours, the most Part of the said Liquor will be voided. Add to these, that the Perspiration will be Augmented at the same Rate, so that from both these Considerations, it is evident, why much Drinking does not always, and immediately, cast Men into Fevers.

3. THERE are few who are Ignorant of the fatal Effects of a long continued Suppression of the Menstrual Blood in young Vigorous Women: But among all these there are none more dangerous than the accute continued Fevers; which it often begets, this it can only do by augmenting the Quantity of the Mass of the Blood; and how much that may be, we shall now examine: It is very well known that the principal Use of this Blood, is for the Nourishment of the *Fætus*, both when it is in the Belly, and on the Breasts; and that very little besides this, is employed, or is necessary to that Purpose, will be evident, to any one, who considers that Nature uses always the most simple, Direct, and Un-

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compounded Means for obtaining her Ends; and never employs many where one might be made sufficient, and therefore would never ordain the Suppression of this Matter, the whole time from the Conception, 'till the Weaning of the Child, and the regular Evacuation of the same at other Times, if it were not mainly, and only necessary for this Purpose. Now *Bellini*, in this Treatise *de Motu Cordis*, Prop. 4. assigns 12 Pounds to be a mean Weight to a Humane *Fætus*, at the time of its Exclusion, some weighed twice as much: And therefore, in the Suppression of the Menstrual Blood in young healthy Women, the Quantity of the Augmentation of the Mass of the Blood, will not be under 21 Ounces every Month; let us take but a Pound, or 16 Ounces, yet it is evident, (if no other Evacuation be encreased, and if the Women be not Naturally very lean, and Destitute of Plenty of Blood) that this in a few Months, will augment the Blood to such a Quantity, as is able to produce a Fever, if any assignable Quantity can do it.

4. **LASELY**, as to the Effects of a violent and long continued Costiveness toward

Continual Fevers. 167

toward a Fever; it must be granted, the *Fæces* do not come from the Blood, and consequently cannot by their Retention augment the Quantity of the same: But it is likewise certain, if they be long suppress'd, and a Man take very near his ordinary Refection, these Effects must necessarily follow. 1. The *Fæces* must be intirely percolated, and all the Juices Nutritious, or otherwise must be squeezed out of them into the Lacteals, which is not so in Persons, who are in the Mean betwixt Constipation and Looseness, as healthful Persons ordinary are, and thus one way the Blood may be augmented thereby. 2. As a Consequence of this, they must extreamly harden, and fill up the Cavity of the Intestines, from the Anus to the Duodenum, and by this Means, the Pancreatick Juice, and Bile, must regurgitate, and consequently the *Ductus Pancreaticus* and *Choladochus*, be obstructed, and how much the Blood may, augmented by the Obstruction of these, one may guess from the 148 Prop. 2^{diæ} p. Borelli *De mot, Animal*. 3. By this hard Repletion of the Intestines, their Glands (which are exceeding numerous) must be obstructed, and thereby the Blood augmented by the Natural Quantity

tity of their Secretion. Thus, from these Considerations, it's clear, that the Quantity of the Mass of Blood, may in a short time be hugely augmented by violent Constipation.

FINIS.

